



Calhoun: The NPS Institutional Archive
DSpace Repository

Theses and Dissertations

1. Thesis and Dissertation Collection, all items

2004-12

Analysis of early separation incentive options to shape the naval force of the future

Reppert, Joseph L.

Monterey, California. Naval Postgraduate School

<http://hdl.handle.net/10945/1236>

This publication is a work of the U.S. Government as defined in Title 17, United States Code, Section 101. Copyright protection is not available for this work in the United States.

Downloaded from NPS Archive: Calhoun



<http://www.nps.edu/library>

Calhoun is the Naval Postgraduate School's public access digital repository for research materials and institutional publications created by the NPS community. Calhoun is named for Professor of Mathematics Guy K. Calhoun, NPS's first appointed -- and published -- scholarly author.

Dudley Knox Library / Naval Postgraduate School
411 Dyer Road / 1 University Circle
Monterey, California USA 93943



NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

**ANALYSIS OF EARLY SEPARATION INCENTIVE
OPTIONS TO SHAPE THE NAVAL FORCE OF THE
FUTURE**

by

Joseph L. Reppert

December 2004

Thesis Advisor:
Co-Advisor:

William Gates
John Mutty

Approved for public release; distribution is unlimited.

THIS PAGE INTENTIONALLY LEFT BLANK

REPORT DOCUMENTATION PAGE			<i>Form Approved OMB No. 0704-0188</i>	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE December 2004	3. REPORT TYPE AND DATES COVERED Master's Thesis	
4. TITLE AND SUBTITLE: Title (Mix case letters) Analysis of Early Separation Incentive Options to Shape the Naval Force of the Future			5. FUNDING NUMBERS	
6. AUTHOR(S) Joseph L. Reppert				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A			10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.			12b. DISTRIBUTION CODE	
13. ABSTRACT (maximum 200 words) The Navy has several tools at its disposal to shape the force, including early separation incentives. This analysis looks at the issues surrounding the separation incentives including the discount rate for government use, the discount rate used by individuals to make a decision (personal discount rate), comparable civilian sector wages for separating personnel, promotion probabilities, and the costs to the government of maintaining personnel until retirement. Using the information provided from researching these topics, a model was created to identify the present value of retirement payments for officers given their current rank, age, and years of service. The model provided a maximum amount the government should be willing to offer to separate an officer early. This model was compared to a second model which determined the minimum amount an officer would be willing to accept to separate before retirement. Recommendations for future methods of shaping the force were provided to maximize savings to the Navy based on data generated from the model.				
14. SUBJECT TERMS Separation Incentives, Annuities, Force Reduction, Cost Benefit Analysis, Government Discount Rate, Civilian Sector Wages, Retirement Compensation, Personal Discount Rate, Military Compensation			15. NUMBER OF PAGES 169	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL	

THIS PAGE INTENTIONALLY LEFT BLANK

Approved for public release; distribution is unlimited.

**ANALYSIS OF EARLY SEPARATION INCENTIVE OPTIONS TO SHAPE THE
NAVAL FORCE OF THE FUTURE**

Joseph L. Reppert
Captain, United States Marine Corps
B.S., United States Naval Academy, 1999

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF BUSINESS ADMINISTRATION

from the

**NAVAL POSTGRADUATE SCHOOL
December 2004**

Author: Joseph L. Reppert

Approved by: Bill Gates
Thesis Advisor

John Mutty
Co-Advisor

Douglas Brook
Dean, Graduate School of Business and Public Policy

THIS PAGE INTENTIONALLY LEFT BLANK

ABSTRACT

The Navy has several tools at its disposal to shape the force, including early separation incentives. This analysis looks at the issues surrounding the separation incentives including the discount rate for government use, the discount rate used by individuals to make a decision (personal discount rate), comparable civilian sector wages for separating personnel, promotion probabilities, and the costs to the government of maintaining personnel until retirement. Using the information provided from researching these topics, a model was created to identify the present value of retirement payments for officers in the Navy given their current rank, age, and years of service. The model provided a maximum amount the government should be willing to offer to voluntarily separate an officer prior to retirement. This model was compared to a second model which determined the minimum amount an officer would be willing to accept to voluntarily separate before retirement. Recommendations for future methods of shaping the force were provided to maximize savings to the Navy based on data generated from the model.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

I.	INTRODUCTION.....	1
A.	PURPOSE AND OBJECTIVES.....	1
B.	RESEARCH QUESTIONS.....	2
1.	Primary Questions	2
2.	Secondary Questions.....	3
C.	THESIS SCOPE.....	3
D.	METHODOLOGY	3
E.	CHAPTER OVERVIEW	4
II.	DESCRIPTION OF SEPARATION INCENTIVE PROGRAMS.....	7
A.	VOLUNTARY SEPARATION INCENTIVE (VSI).....	7
B.	SELECTIVE SEPARATION BONUS (SSB).....	8
C.	TEMPORARY EARLY RETIREMENT ACT (TERA).....	8
D.	CAREER STATUS BONUS (CSB).....	9
E.	RETIREMENT	10
F.	INVOLUNTARY SEPARATION	11
G.	SUMMARY	12
III.	RESULT OF INCENTIVE PROGRAMS.....	13
A.	QUANTITY OF SEPARATIONS.....	13
B.	QUALITY OF SEPARATIONS.....	14
C.	COST OF EARLY INCENTIVE PAYMENTS.....	16
D.	EVALUATION OF THE PROGRAMS	17
E.	POSSIBLE PROBLEMS.....	18
IV.	CHOOSING A GOVERNMENT DISCOUNT RATE.....	21
A.	METHODOLOGIES AVAILABLE TO CHOOSE A DISCOUNT RATE	23
1.	Consumer Rate of Interest	25
2.	Opportunity Cost of Capital	26
3.	Treasury Bill Rate of Return	27
4.	Shadow Price of Capital	28
5.	Weighted Average Discount Rate.....	29
6.	Rate of Time Preference.....	30
7.	Rate of Return on a Marginal Project or Opportunity Cost Rate of Return.....	31
8.	Pre-Tax Rate of Return on Private Investment	33
9.	Marginal Cost of Funds.....	34
B.	DISCOUNT RATE USED BY VARIOUS GOVERNMENT AGENCIES.....	36
1.	Government Accountability Office (GAO).....	36
2.	Congressional Budget Office (CBO)	38
3.	Office of Management and Budget (OMB)	39

C.	RATES USED IN COMPARABLE STUDIES	42
D.	DISCOUNT RATE USED TO CONDUCT ANALYSIS IN THIS STUDY	44
V.	INDIVIDUAL DECISION MAKING	47
A.	INDICATIONS OF PERSONAL DISCOUNT RATE FROM PREVIOUS DECISIONS	47
B.	ESTIMATE OF CIVILIAN SECTOR WAGES	49
C.	OTHER CONSIDERATIONS CONCERNING SEPARATION DECISIONS	52
1.	Knowledge	52
2.	Job Security	53
3.	Age	53
4.	Motivation	54
D.	IMPLICATIONS FOR FUTURE EARLY SEPARATION INCENTIVES	54
VI.	DATA AND METHODOLOGY	57
A.	BASIC PAY	58
B.	RANK	58
C.	PROMOTION AND RETENTION RATES	58
D.	YEARS OF SERVICE AT RETIRMENT	60
E.	AGE	60
F.	YEARS OF SERVICE (YOS)	61
G.	LIFE EXPECTANCY	62
H.	DISCOUNT RATE	63
I.	COMPUTATIONS WITHIN THE MODEL	63
1.	Annual Retirement Payment	63
2.	Maximum Lump Sum Offer	63
3.	Maximum Annuity Offer	64
4.	Theoretical SSB/VSI Payments Based on Previous Policies	64
5.	Minimum Incentive for Individuals	64
6.	Cost Savings to the Navy	64
J.	SIMULATION PROCEDURES	65
VII.	DATA ANALYSIS AND INTERPRETATION	67
A.	SIMULATION RESULTS	67
1.	Navy's Maximum Recommended Incentive Offer	67
2.	Theoretical VSI Offer	68
3.	Theoretical SSB Offer	68
4.	Minimum Payment for Individual Acceptance	69
B.	COMPARISON OF RESULTS	69
1.	Navy Savings Compared to Theoretical VSI Offer	69
2.	Navy Savings Compared to Theoretical SSB Offer	70
3.	Navy Savings Compared to Individual Minimum Acceptance Amount	71

4.	Theoretical VSI/SSB Compared to Individual Minimum Acceptance Amount.....	72
C.	POLICY CONSIDERATIONS.....	72
VIII.	OTHER CONSIDERATIONS.....	77
A.	OTHER RETIREMENT COSTS.....	77
1.	Medical Benefits.....	77
2.	Other Benefits.....	77
B.	ACTIVE DUTY COSTS.....	78
IX.	CONCLUSIONS AND RECOMMENDATIONS.....	79
A.	SUMMARY	79
1.	Discount Rate	79
2.	Personal Decisions.....	79
3.	Evaluation of Data	80
B.	RECOMMENDATIONS.....	81
C.	FURTHER RESEARCH.....	82
D.	CONCLUSION	83
	APPENDIX A - TERA RETIRED PAYMENT CONVERSIONS.....	85
	APPENDIX B – 2005 OFFICER MONTHLY PAY TABLES	87
	APPENDIX C - PROMOTION AND RETENTION DECISION TREES	89
	APPENDIX D - MODEL DISTRIBUTIONS.....	93
	APPENDIX E - LIFE EXPECTANCY TABLE	99
	APPENDIX F –MODEL SAMPLE.....	101
	APPENDIX G – SIMULATION RESULTS	103
A.	MAXIMUM LUMP SUM OFFER BY NAVY.....	103
1.	Lieutenant (O-3).....	103
2.	Lieutenant Commander (O-4)	106
3.	Commander (O-5).....	109
B.	THEORETICAL VSI (ANNUITY) PRESENT VALUE	112
1.	Lieutenant (O-3).....	112
2.	Lieutenant Commander (O-4)	113
3.	Commander (O-5).....	114
C.	NAVY ANNUITY SAVINGS: COMPARISON OF THEORETICAL VSI AND MAXIMUM OFFER AMOUNT BY NAVY.....	115
1.	Lieutenant (O-3).....	115
2.	Lieutenant Commander (O-4)	118
3.	Commander (O-5).....	121
D.	THEORETICAL SSB (LUMP SUM)	124
1.	Lieutenant (O-3).....	124
2.	Lieutenant Commander (O-4)	125
3.	Commander (O-5).....	126

E.	NAVY LUMP SUM SAVINGS: COMPARISON OF THEORETICAL SSB AND MAXIMUM OFFER AMOUNT BY NAVY	127
1.	Lieutenant (O-3).....	127
2.	Lieutenant Commander (O-4)	130
3.	Commander (O-5).....	133
F.	INDIVIDUAL MINIMUM REQUIREMENT (PERSONAL DISCOUNT RATE).....	136
APPENDIX H – ACTIVE DUTY COST ANALYSIS.....		139
A.	BASIC PAY	139
B.	BASIC ALLOWANCE FOR HOUSING (BAH)	139
C.	BASIC ALLOWANCE FOR SUBSISTENCE.....	140
D.	SPECIAL PAY AND INCENTIVES	140
E.	MEDICAL BENEFITS	141
F.	OTHER NON- CASH COMPENSATION.....	141
G.	CALCULATIONS	142
1.	Method of Calculations.....	142
2.	Calculation Results	142
3.	Comparison of Active Duty Calculations and Retirement Calculations	144
LIST OF REFERENCES.....		145
INITIAL DISTRIBUTION LIST		151

LIST OF FIGURES

Figure 1.	Comparison of Military Members' Regular Military Compensation with Civilian Earnings with Some College Education: 2000-2004 (From Pleeter, 2004).....	51
Figure 2.	Maximum amount Navy is Required to Pay to Ensure 25% of Lieutenants Separate.....	73
Figure 3.	Minimum Amount Required by 25% of Individuals to Separate Early.....	74

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF TABLES

Table 1.	Summary of Government Discount Rate Methodologies	23
Table 2.	Summary of Observed Cost Benefit Analyses.....	43
Table 3.	Navy Maximum Recommended Incentive Offer.....	67
Table 4.	Present Value of Theoretical VSI (Annuity) Offer	68
Table 5.	Theoretical SSB (Lump Sum) Offer	68
Table 6.	Individual's Minimum Incentive Payment	69
Table 7.	Potential Savings to the Navy Based on Theoretical VSI Offers	69
Table 8.	Potential Savings to the Navy Based on Theoretical SSB Offers.....	70
Table 9.	Comparison of Navy's Maximum Offer Amount and Individual's Minimum Acceptance Amount.....	71
Table 10.	Comparison of Theoretical VSI and Individual Minimum Acceptance Amount	72
Table 11.	Comparison of Theoretical SSB and Individuals Minimum Acceptance Amount	72

THIS PAGE INTENTIONALLY LEFT BLANK

ACKNOWLEDGMENTS

I would like to thank Professors Gates and Mutty for their patience, dedication, and wisdom in making this research a valuable learning experience. I would also like to thank the faculty and staff of the Graduate School of Business and Public Policy for expanding my horizons; teaching me how to analyze, think, and communicate; and challenging me to continuously improve. Finally, to my family and friends thank you for all of your support, encouragement and advice. Without the help of all of you this research would not have been completed.

THIS PAGE INTENTIONALLY LEFT BLANK

I. INTRODUCTION

A. PURPOSE AND OBJECTIVES

After the end of the Cold War, the Department of Defense faced challenges of reducing its force. The drawdown of the 1990s required the Navy to develop methods to reduce manpower consistent with new efficiency objectives of the Department of Defense. Since the inception of the all volunteer force, there had not been a requirement to reduce manpower levels. Although there were policies in place to ensure the proper force structure, they did not provide the tools to decrease the size of the military to the extent planned. The Department of Defense had to develop new methods to downsize which would achieve its efficiency goals and maintain the morale required for optimum performance.

The Department of Defense and Congress wanted to avoid using involuntary separations or reductions in force to a greater extent than they were already using. They felt that increasing involuntary separations would have a negative effect on morale possibly leading to a reduction in productivity and efficiency of the force. At this time, there was a belief among military personnel that if they remained on active duty for eight to ten years, they would be permitted to remain on active duty until they were eligible for retirement. Using involuntary reductions would have undermined that belief and would have had a large impact on morale, especially for mid-level personnel (Rogge, 1996).

The Department of Defense had to develop a system that would compliment the reduction in accessions and the involuntary (up or out) separations that were already in place. The 1992 National Defense Authorization Act attempted to aid the Department of Defense in its downsizing efforts. This act called for the Department of Defense to reduce its manpower levels by 15% by fiscal year 1995 and provided the authority to offer voluntary separation incentives. By relaxing regulations regarding force levels and authorizing the use of incentives, Congress provided more tools to help the Department in reducing its force in the 1992 Department of Defense Appropriations Bill.

Much of the research has already been conducted to study the characteristics of those who accepted or rejected the voluntary incentives. Likewise there have been

studies on the comparisons of the Voluntary Separation Incentive (VSI) and the Selective Separation Bonus (SSB) options, to include the break even points. The Navy's continued emphasis on maximizing efficiency may create solutions that will allow further force reductions. While the policies of the 1990s were successful in reducing the force, there appeared to be inefficiencies in the implementation of the policies. A large number of personnel who accepted early separation incentives would have separated voluntarily without the incentives. By developing a better mechanism for offering separation incentives, the Navy may be able to meet its goals of reducing force levels, maintaining quality personnel and optimizing its cost savings.

The purpose of this thesis is to identify the costs that the Navy encounters when retiring personnel. These costs will be compared to the separation incentive costs to determine savings to the Navy. Several issues surrounding the costs and savings will be discussed, including the government discount rate, factors affecting individual separation decisions, and non-financial compensation costs, to identify possible targets and methods for future separation incentives. This thesis discusses the issues that should be considered when creating future incentive policies. Rather than looking at past costs, this thesis analyzes current and future costs. Finally, this research will provide a model that will determine the costs for retirement, VSI, and SSB alternatives given an officer's general characteristics. The model will help to predict an officers' required value to separate voluntarily given their personal set of traits. The prediction will determine the level of funding that would make the program cost effective to implement and should help form a foundation for determining a more cost effective and efficient way for the Navy to reduce the force in the future.

B. RESEARCH QUESTIONS

There are many questions that are unanswered concerning how to conduct separation incentives in the future. This research aims to answer several basic questions as a foundation for developing future programs to shape the force through separation incentives.

1. Primary Questions

The primary focus of this research is to answer the questions:

What is the maximum amount the Navy should be willing to pay to provide a separation incentive?

What is the minimum amount individuals would be willing to accept to separate prior to retirement?

2. Secondary Questions

In order to thoroughly answer the primary questions there are several secondary questions to answer. These questions include the use of the discount rate; the cost to the government for a service member to retire, including active duty and retirement pay; the personal discount rate used by service members in making decisions; and the civilian wages expected when a service member separates.

C. THESIS SCOPE

The majority of the thesis focuses on the officer population of the Navy. This does not include the Marine Corps. During the drawdown of the 1990s, the Marine Corps developed its own policies and strategies for reducing the force. An assumption is made that the Marine Corps will implement its own policies for force reduction if necessary in the future. Although there is information regarding early separation incentives in the military, very little focuses on officers in the Navy. In order to gain background information concerning the incentives, research was conducted for all Department of Defense populations to include all services and ranks. Expanding the research provided a more thorough understanding of the general issues surrounding separation incentives. The separation incentive policies of the 1990s largely targeted officers in the ranks of Lieutenant (O-3) through Commander (O-5). This research focuses on the same target population. The financial analysis is largely based on projected pay rates for 2005.

D. METHODOLOGY

The methodology used to write this thesis included a literature review. The literature review provided background information and insights into the separation incentive policies and the behavior of military personnel in reacting to these policies. An

extensive literature review was also conducted to obtain information concerning the proper government discount rate as well as comparable civilian sector wages and the personal discount rate.

After determining the proper discount rate to use, a model was created to analyze costs and potential savings to the Navy. The model links rank (pay grade), age, years of service (both officer and enlisted), promotion and retention projections, potential retirement years of service, and life expectancy along with the discount rate to determine the costs and savings to the Navy. Using the Crystal Ball add-in for Excel, simulations of the model were run to determine the values of each separation incentive, the costs to the Navy of retirement, and the amount that individuals need to accept the offers. Finally, independent of the model, costs to the Navy for active duty personnel are considered and compared with the results of the model.

E. CHAPTER OVERVIEW

Chapter II provides a brief discussion of the potential separation methods for the Navy. A detailed description of the calculations in determining the cost to the Navy is included as well as some of the characteristics of each method. Several strengths and weaknesses of each method are also included in this chapter.

Chapter III evaluates the methods for shaping the force. The discussion provides data from past studies to determine the effectiveness of the program. Two major areas, quality and quantity, are evaluated. This chapter concludes by identifying possible problems of the prior policies for early separation incentives.

Chapter IV discusses the government discount rate. As part of this discussion, several terms are defined, including opportunity cost and risk. This chapter identifies nine potential ways to calculate the government discount rate, briefly discusses the methods for calculation and provides possible strengths and weaknesses where appropriate. The chapter follows with a discussion of how the major government analysis agencies, the Government Accountability Office, the Congressional Budget Office and the Office of Management and Budget, determine the government discount

rate for use in their analysis. Finally, a decision is made concerning the discount rate used for the remainder of this thesis.

Chapter V describes the individual's approach to making the decision regarding acceptance of the separation incentive. The chapter includes a discussion of the personal discount rate, comparable civilian wages, other considerations made by individuals, and provides suggestions for the future.

Chapter VI describes the model created to evaluate the Navy's costs and savings from the early incentives. It contains information about how the model was constructed and background information concerning the variables. Finally, this chapter discusses the mechanics of running the simulations for the model.

Chapter VII discusses the results from the model simulation. It provides the data in terms of specific individual categories and follows that discussion with a comparison of several programs. The comparisons involve the maximum amount the Navy should be willing to pay as an incentive, the VSI and SSB costs, by applying current pay rates to the policies of the 1990s, and the minimum amount individuals would be willing to accept.

Chapter VIII describes several other considerations that are important for creating the proper separation incentive that were not included in the model. These considerations include non-cash benefits such as medical and base privilege benefits for retirees. It also includes a discussion about the appropriateness of including the cost to maintain personnel on active duty in the analysis of costs and savings of the separation incentive programs.

THIS PAGE INTENTIONALLY LEFT BLANK

II. DESCRIPTION OF SEPARATION INCENTIVE PROGRAMS

The Department of Defense has used several approaches to shape size and composition of its force structure in the past. This occurred most recently in the early 1990's. To identify the best method of shaping the force it is important to understand what the separation options are and the costs and benefits of each. When the separation incentive programs are in place, there are essentially six options for personnel to leave the service. These options include the Voluntary Separation Incentive (VSI), the Selective Separation Benefit (SSB), the Temporary Early Retirement Act (TERA), the Career Status Bonus (CSB), involuntary separation, and retirement. Each of the early separation programs provides a benefit to the Navy but each also carries its unique costs. Several of these programs are continuous, such as retirement. Other programs, such as VSI or SSB, are special programs introduced to meet manpower requirements. While these programs are established with a target group to be reduced, they often create opportunities for separation for those that the Navy wants to retain. The following describes each program and some of its characteristics.

A. VOLUNTARY SEPARATION INCENTIVE (VSI)

VSI provides an annuity to personnel who choose to leave active duty service early. The VSI computation is based on a percentage of monthly pay and years of service. The equation for determining the exact VSI payment is:

$$\text{VSI annuity} = 2.5\% * \text{Final Month Base Pay} * 12 \text{ months} * \text{Years of Service}$$

The payments continue for a period which is two times the number of years of service. The payment is made on the anniversary of the separation date. When accepting the program, personnel lose the privileges afforded to retired personnel with several specific and temporary exceptions. Personnel selecting this option must serve in a Reserve component for at least three years after accepting the separation incentive. During the time that they receive VSI payments, personnel are not eligible to receive reserve pay (Viltz, 2004).

There are several eligibility requirements personnel must meet to be considered for an early separation incentive. These requirements are mandated by the Department of Defense. The general guidelines are that personnel must have served on active duty for at least six years as of December 1991; have completed the initial enlisted or obligated service; the last five years of active duty service must be continuous; and personnel cannot be eligible for retirement pay (Viltz, 2004). Each service also has the ability to enforce specific criteria for eligible members in areas such as years of service, rank, specialty designator or remaining obligated service. By giving the services some latitude in constructing eligibility criteria, the Department of Defense and Congress allow each service to meet the required downsizing goals using the method that is best suited for the service.

B. SELECTIVE SEPARATION BONUS (SSB)

SSB provides a lump sum payment as an early separation incentive. The lump sum payment is computed in a fashion similar to the VSI computation. The equation for determining the exact SSB payment is:

$$\text{SSB} = 15\% * \text{Final Month Base Pay} * 12 \text{ months} * \text{Years of Service}$$

Under this option, personnel will receive a lump sum payment based on the above equation. The same requirements for eligibility that apply to VSI apply to SSB to include serving in a Reserve component for at least three years (Viltz, 2004). Personnel choosing this option also lose their retirement privileges except for certain specific accommodations which are maintained temporarily.

C. TEMPORARY EARLY RETIREMENT ACT (TERA)

TERA is a program which allows personnel to retire before they reach 20 years of service. Personnel can retire early when they have reached 15 years of service. Personnel choosing this option will maintain the same benefits afforded to other retirees except the amount of their retirement pay.

The TERA provisions further allow for personnel to gain points towards retirement by working in a civil service job between the period of early retirement and

the point when they would have had 20 years of service. If they work in an approved job from the time they retire early until when they would have been eligible for retirement they will be eligible to have their retirement payment increased at age 62. Each month of approved service after acceptance of TERA provides personnel with approximately a .25% increase in their retirement payment when they become eligible. This is approximately a 2.5% increase per year with a monthly reduction factor.

The TERA retirement payment is based upon the years and months of service. Based on this time, a percentage of the service member's current base pay is paid on a monthly basis. If personnel work from the time they retire early to the time that would have been their 20 year retirement date, they will receive 50% of their base pay at age 62, as if they retired after 20 years. Appendix A provides a table which can be used to determine the percentage of base pay personnel will receive under the TERA option (TERA, 2004).

D. CAREER STATUS BONUS (CSB)

The Career Status Bonus (CSB) is another option for the Navy to manage retirement and manpower. Although this option does not influence personnel to separate from active duty early, it reduces the Department of Defense's costs of retirement payments. Under this program, personnel elect to receive \$30,000 at the time that they reach 15 years of service. This amount is fully taxable. Personnel must remain on active duty until 20 years of service. If they decide to retire after 20 years of service, they will receive 40% of their final basic pay for their retirement pay. These payments are received monthly for the remainder of the service member's life. Personnel who choose to remain on active duty past twenty years will receive an additional 3.5% for every year that they remain past 20 years of service. The retirement amount does not benefit from a full Cost of Living Allowance (COLA) adjustment each year. Personnel retiring under the CSB have a 1% smaller COLA adjustment than those retiring under the traditional method. When retirees turn 62 under this program, there is a one time adjustment which "catches personnel up" with equivalent payments to regular retirees based on previous COLA adjustments. After this one time adjustment, however, the COLA adjustment continues to be reduced by 1% (Marine Corps Times, 2004). Personnel who elect this

option are afforded all of the other benefits of retirement that they would have received had they not chosen the CSB.

This program is beneficial to the Department of Defense because it reduces the cost of a retired service member. Although the initial cost of \$30,000 is significant, the Department of Defense makes up this early deficit with savings in reduced future retirement payments.

The benefit to service members from this program is that they obtain a large payment earlier than normal. This can be beneficial if the money is used properly; but can be a distinct disadvantage if service members do not use the money wisely. The disadvantage for service members occurs when they actually retire and receive a smaller retirement payment. For those that expect to remain on active duty past 20 years, the CSB appears to be a better option the longer personnel remain on active duty.

The Career Status Bonus continues to be available to military personnel when they reach 15 years of service. This payment provides savings to the Navy because the annuity that will usually be paid is less than if personnel would wait to gain full retirement at 20 years of service. This program does not affect manpower levels however. Personnel still remain on active duty to at least 20 years. In some cases this is actually an incentive to remain on active duty in order to receive a larger percentage of retirement pay. The focus of this thesis is on tools that could be used to reduce the force and compare them to the cost of retirement to the Navy. For this reason, the Career Status Bonus is not computed or analyzed in this study.

E. RETIREMENT

The retirement option for military personnel is a permanent option for separation. This option permits personnel to leave active duty after at least 20 years of service, and receive monthly retirement payments for the remainder of their lives. The retirement payment is computed by taking 50% of the average of the highest three years of basic pay earnings on active duty. Typically these three years are the last three of the career. If a service member remains on active duty past 20 years of service, the retirement payment

increases 2.5% for each additional year. Additionally, COLA adjustments are made for retirement payments on an annual basis.

The retirement plan is a great benefit for service members. They are guaranteed a monthly check for the rest of their lives. Further, retirees enjoy most of the benefits that active duty members enjoy, including health care and base privileges.

For the Department of Defense, the retirement option is the most costly. Not only must it make monthly payments, but it also provides many services to retirees. Finally, by maintaining personnel until retirement, the military pays a relatively high salary because personnel are more senior than would be the case if early separation incentives were accepted. The advantage to the Department of Defense is the morale of personnel who believe that if they give good effort they will be rewarded with a generous pension. The Department of Defense also benefits from the experience and knowledge of more senior personnel in the years leading to their retirement. Retirement annuities are computed based on the equation:

$$\text{Monthly Base Pay} * 12 * (50\% + 2.5\% * (\text{Years of Service at Retirement} - 20))$$

F. INVOLUNTARY SEPARATION

Using guidance provided by the Defense Officer Personnel Management Act (DOPMA) of 1980, the Department of the Navy has established tools in its manpower structure to require personnel who do not meet standards of performance and are not moving up in rank to leave the service involuntarily. This is not a popular tool among personnel and can have a negative effect on morale. It can also be a motivational tool for those who understand that they must perform or leave the service.

This method is avoided as much as possible by the services. It strains morale and negatively affects the attitudes of officers on active duty. It is also unpopular with Congress. They believe that officers should have the ability to retire if they are willing to make a 20 year commitment to active duty. The DOPMA regulations make it very difficult for officers to be involuntarily separated. It is also expensive, not only in terms of financial payments, but more importantly in terms of intangible costs to the services.

While there have been periods when DOPMA restrictions have been reduced to allow involuntary separations, the services attempt to avoid this. In cases where officers do not meet the “up or out” standard, they are usually at a point in their career very near retirement. Often the services will keep the officers on active duty until retirement and then separate them, providing them with benefits. For this reason, involuntary separations are not an attractive tool for the Navy to shape the force and will not be included in the comparisons for this analysis.

G. SUMMARY

During the 1990’s, there were six options for personnel to leave active duty. These options included the Voluntary Separation Incentive (VSI), the Selective Separation Benefit (SSB), the Temporary Early Retirement Act (TERA), the Career Status Bonus (CSB), involuntary separation, or retirement. It is important to understand the history of the programs and their characteristics to begin to develop new strategies for shaping the force of the future. Each of these programs provides advantages and disadvantages to both the individual and the Navy. The temporary programs that were introduced to shape the force were developed with a specific manning goal and demographic in mind. When evaluating these programs, Asch and Warner believe that there are two issues that must be addressed: Was the number of separations greater than expected? Did the incentives induce lower quality or higher quality personnel to separate (2001)? These issues will be addressed in the following chapter.

III. RESULT OF INCENTIVE PROGRAMS

There are two factors that must be considered in evaluating if the separation incentive programs were successful, according to Asch and Warner. These two factors are the number of separations that resulted from the programs and the quality of the personnel that separated (2001). These two characteristics will be evaluated below as well as an overall evaluation of the programs and possible problems with the programs.

Although this study focuses on officers in the Navy, the analysis of quality and quantity will be based on previous research conducted for both enlisted and officer populations in the different services within the Department of Defense during the period of force shaping. It is understood that the different services implemented the separation programs in slightly different ways. Further, enlisted personnel and officers are demographically different and make decisions in different ways. It is not possible therefore, to compare the studies of different services and ranks with complete accuracy. Reviewing all of the research and literature does provide background information into the general characteristics and results of previous early separation programs. The resulting background information is used in this research as a basis for discussion of separation incentives in the future by incorporating evaluations based on similar programs among the services for both enlisted personnel and officers.

A. QUANTITY OF SEPARATIONS

Observations of Navy enlisted personnel in 1992, the first year early separation bonuses were offered, show that 12.1% of those eligible accepted an early separation bonus. Of the 12.1%, 84.8% chose the SSB lump sum payment over the VSI annuity. Air Force enlisted personnel observed during the same time period had an acceptance rate of 15.9%. One of the theories for the increased Air Force rate is the fact that Air Force personnel were faced with possible involuntary separations if they did not choose to separate voluntarily (Mehay & Hogan, 1998).

Hemleben analyzed the results from Marine Corps enlisted personnel for fiscal year 1992. His results conclude that 1083 or 11.1% of the 9772 personnel offered an early separation incentive in the Marine Corps accepted the offer (1993).

Rogge analyzed the results of naval officers who separated in 1993 using the Annualized Cost of Leaving (ACOL) model. According to his analysis, 585 of the 848 officers separating under the separation incentive programs, or 69% of the total, would have separated without the incentive; they obtained an economic rent¹. 263 officers of 848, or 31%, made the decision to separate from the Navy as a result of the separation incentives (1996).

Giarrizzo analyzed enlisted acceptance rates for the Navy for offers made in 1993. During this period, 26,325 sailors were eligible for the early separation bonuses. 2,992 sailors or 11.4% accepted the bonus and separated from the Navy (1993).

It appears that the Department of Defense was able to separate the intended quantity of personnel to meet its goals. In the first year of the programs, the Army was able to increase its separations by 100% (Asch & Warner, 2001). While these programs provided economic rents to individuals who were going to separate without an incentive, this appears to be a “cost of doing business.” Efforts to eliminate the economic rents could provide savings to the Department of Defense, but in terms of reducing the force, the VSI and SSB programs were successful.

B. QUALITY OF SEPARATIONS

It is important for the Navy to separate personnel who demonstrate low performance and maintain personnel who are quality performers and make an impact. One hypothesis is that personnel who regard their opportunities within the Navy as limited would choose to separate and attempt to find success in the civilian work force. The counter to that hypothesis is that high performers could believe that they are not being properly compensated for their performance in the Navy and expect to find a more satisfying and lucrative job in the civilian market. The Navy hopes that the former case

¹ Economic rent is defined as an extra benefit received by personnel as a result of a program. In this case personnel would have separated without a financial incentive. The separation incentive they received was a bonus but did not influence the decision to separate.

was more prevalent during the VSI/SSB program than the latter. If this is true, the Navy could separate lower quality performers and maintain the high performers.

It was also important for the Navy to ensure it maintained a force that would be effective in the future. As a result, several other considerations entered into the separation incentive design. These considerations included matching military and national strategy objectives with the end-strength goals, and ensuring the remaining force had the necessary skills, training, and experience to meet the objectives identified (Kirby, 1993). The quality of the separation incentive program should be based not only on the quality of the individuals that remained in the service, but also in the quality of the entire organization and the ability to fight the nation's wars of the future.

Asch and Warner conducted a study that evaluated Army enlisted personnel, their characteristics and their actions, to determine the quality of personnel that were separated. They found that those without a high school diploma were 19% more likely to accept the early separation incentive than those with a high school diploma. Those who scored in the bottom half on the Armed Forces Qualification Test (AFQT) were 6% more likely to accept the offer than those in the top half. And personnel with an extra year in grade were 8% more likely to accept the early separation payment than those without an extra year. At the end of their study, Asch and Warner concluded that, "To the extent that separation pay can be combined with an implicit or explicit threat of involuntary separation, the results suggest it is possible to design a separation pay program to target to some extent the separation of less-educated and marginal performers (2001)."

Hemleben's study of Marine Corps enlisted personnel in 1992 was unable to say conclusively that lower performers accepted the early separation bonuses at a higher rate. He was able to infer, given his results, that it appeared that acceptance rates from high performers were lower than the acceptance rates for lower performers (1993).

In his evaluation of Navy enlisted personnel during 1992, Rogge concluded that those with a high AFQT were not more likely than those with lower scores to accept the separation incentives. The AFQT was used as a measure of performance. Using this result, Rogge concluded that the separation incentives did not create a gap in the quality of the Naval force (1996).

With its eligibility policies, the Navy tried to target mid-level enlisted personnel in pay grades E-5 or E-6 who were working in overfilled occupational areas, and had ten or more years of service. Unlike several of the other services, the Navy made it clear to personnel that if they did not accept the voluntary separation they were not in immediate danger of being involuntarily separated. Although there was no threat of involuntary separations, it appears that the Navy was successful in separating lower performers and retaining the high performers. While other services had slightly different policies, studies on their effectiveness show that the Department of Defense as a whole successfully maintained a quality force in the implementation of the early separation programs. Finally, although officers were not observed for quality in studies of the early separation programs the general trend across the Department of Defense appears to be that overall quality of the force was maintained.

C. COST OF EARLY INCENTIVE PAYMENTS

Although the Department of Defense was successful in reducing the level of its officer corps, the success came at a price. The average SSB payment for the period 1991-1996 was \$58,200 and \$50,900 for Captains in the Army and Air Force, respectively. This figure should actually be doubled because during this time about half of the officers accepting the SSB payment would have separated voluntarily without a payment. If the Department of Defense had instead implemented a program with involuntary separations, the average cost for the O-3 pay grade would have been approximately \$26,300 (Smith, 1999). In their study of the personal discount rate, however, Warner and Pleeter concluded that the government saved approximately \$1.7 billion using a 7% discount rate. Most of the savings are attributed to individuals accepting a lump sum payment instead of the annuity (Warner & Pleeter, 2001).

There were also other benefits that were offered to personnel who accepted the early separation incentive. These benefits included pre-separation counseling, employment assistance, relocation assistance, transition health care up to 120 days after separation, two years of commissary and exchange privileges, ten days permissive temporary duty for relocation, separation leave, use of military housing for up to 180 days, and the Montgomery GI bill enrollment opportunity (Kirby, 1993). These benefits

are also afforded to any of the other separation options. As a result, these costs were not allocated to any of the programs in this analysis.

D. EVALUATION OF THE PROGRAMS

In their study, Asch and Warner concluded that the Army enlisted take rate would have been reduced if the offer was extended to those personnel who were initially ineligible for the incentive. This statement provides evidence that the Army was able to successfully target their intended market to make the program as successful as possible. Using the Army as the representative group, it appears the Department of Defense was able to attract people to leave with its incentives ultimately accomplishing the downsizing of personnel it sought.

Prior to implementing the separation incentive program (1990), the annual officer separation rate was about 10%. After implementing the incentive programs (1991-1996) the separation rate increased to about 11% of the officer population. The program also succeeded in targeting mid level officers (Smith, 1999).

TERA also appeared to be successful in increasing the separation rate of more experienced officers. The number of officers with 15-20 years of service who voluntarily separated increased from 1.5% in 1990 to 4.7% from 1991-1996. Further analysis also indicates that most of the officers accepting this program would have stayed on active duty until retirement without the incentive (Smith, 1999).

Rogge's calculations, which included the cost of the economic rents and the savings from those who were influenced to separate, concluded that the Navy saved \$189.5 million in economic benefit from its separation program in 1993. The initial costs associated with the program were \$48.4 million. The separation incentive program resulted in net discounted benefits of \$141.1 million (1996).

Overall, the Department of Defense and the Navy appeared to be successful in using early separation incentives to shape the force and meet their manpower goals. The two issues of quality and quantity were addressed and successfully targeted in the programs. The programs created a balance in the quantity of personnel voluntarily separating. The services were able to meet their reduction goals without enticing too

many personnel to voluntarily separate. Likewise, the quality of the forces was maintained and in some instances improved because lower performers disproportionately accepted the incentive.

E. POSSIBLE PROBLEMS

One of the problems with offering incentives to separate early is that personnel who were planning to leave without the payment are being paid for no reason. In 1992, about half of those personnel who received the payment were likely to leave without the incentive payment. This is a large cost to the government. Although the program was successful, it became more costly because the Department of Defense was unable to distinguish between those who needed the incentive to leave and those who were already going to leave. If it could have done this it would have doubled its savings from the VSI/SSB programs.

Another issue involved in the incentives is the motivation to leave. There are two primary reasons that personnel will decide to leave active duty. Some service members believe that they have better opportunities outside the Navy. Presumably these are the higher performers or personnel in fields that can easily transition to the civilian sector. The other group of takers involves those who believe their opportunities within the Navy are limited and see the separation incentive as a way to get out. Usually these are the lower performers who may not know what they want to do when they separate, but believe that they will not make it to retirement and want some benefit for all of their work. These reasons implicitly assume that personnel have perceptions about their promotion status as well as their job opportunities in the civilian sector. This may be the case for some informed personnel, but many may not know where they stand in terms of their future, either on active duty or working in the civilian sector. Ideally, the Navy would target those who have limited military opportunities, but it is hard to effectively determine the exact reasons personnel accepted the incentive and left the service early.

Voluntary incentives also tended to create a force that contained more senior officers. In the Navy, according to a Congressional Budget Office report, the percentage of officers with less than eight years of service declined from 42-32% from 1987-1997 (Lind, 1990). The Navy must be careful not to create large gaps in their officer force.

This could result from separating too many mid-level officers. A gap could require senior officers to fill junior billets, which would have a tremendous effect on morale. Alternatively, it could also require promoting junior officers to fill more senior billets before they are ready. Neither of these outcomes is favorable, and could harm the Navy's future effectiveness. To avoid this situation, the Navy must ensure an appropriate spread of officers is separated. Although the Navy was successful in targeting its desired group of officers, this could possibly have an effect on the proficiency of the officer corps by creating a gap in terms of experience and rank. It must be careful about the population and quantity of the officers that it separates to maintain a productive and capable fighting force.

THIS PAGE INTENTIONALLY LEFT BLANK

IV. CHOOSING A GOVERNMENT DISCOUNT RATE

When conducting cost benefit analyses it is important to incorporate a discount rate. Discount rates adjust values of a future period to compare them with values in the present. Essentially, the discount rate accounts for the fact that a dollar obtained today is more valuable than a dollar obtained in the future; the discount rate reflects how much more valuable the dollar is today. In terms of time span, when costs are incurred in early periods but the benefits are not received until later periods, a higher discount rate results in a lower present value of net benefits (Office of Management and Budget, 1992). The discount rate allows the user to determine the value today of a benefit that will be received in some time period in the future. It provides a factor to convert costs and benefits realized in different time periods into a common form of measurement for comparison. Higher discount rates reduce the present value of future cash flows.

Discount rates also permit the comparison of projects that produce benefits at different times. They provide common language by expressing dollar figures in common terms across projects and time periods. If different rates are used inappropriately or inconsistently, it will skew the cost benefit analysis and invalidate measures of alternative programs or investments. While the discount rate is a simple principle in theory, it becomes complex because the choice of a discount rate has substantial influence on analyses and thus the resulting policy decisions.

Many economists have analyzed this important question, but there still is uncertainty about which discount rate is most appropriate to evaluate government programs. There have been major strides in the past decade to identify an appropriate rate. Even after extensive research and study, there is a sense that the perfect rate has not yet been identified. Some agencies conducting cost benefit analysis even avoid the question as much as possible. Most recommend sensitivity analysis to attempt to capture a range of acceptable rates.

One of the elements of the discount rate incorporated into nearly every analysis is opportunity cost. Opportunity cost implies a trade-off among projects. This measure captures the benefit foregone from one project as a result of selecting an alternative

project. Ideally, decision makers should pursue the projects that have the lowest opportunity cost. If this is the case, they achieve the maximum benefit from projects they select. Analyses of the government discount rate view opportunity cost in several ways. Quirk and Terasawa identify opportunity cost as the portfolio of unfunded projects (1987). The Office of Management and Budget (OMB) interprets government opportunity cost as the cost to the government of borrowing (1992). Lind views the government opportunity cost as the forgone benefit of returns in the private sector from either consumption or investment (1990). When determining the government discount rate, analysts take into account opportunity cost. The differing views concerning the opportunity cost produce different values for the government discount rate. Although analysts do not agree on the exact opportunity cost to the government, they all understand the importance of including it as a factor in determining the government's discount rate.

A second important issue is risk. In the discussion of a proper discount rate, there are two approaches to dealing with risk. The first approach which is described by Bazelon and Smetters is that the discount rate should include risk (1999). There is disagreement about how to include risk in the discount rate based on this approach. The first argument is that the government is able to pool many resources and can limit its risk. These analysts believe that risk should be included in the discussion of the discount rate but that the government is not greatly affected by it (Quirk & Terasawa, 1987). The second thought is that the government does possess risk and uncertainty when it decides on certain programs, and as a result risk should be included in the discount rate. The second approach to identifying risk is to include it in the valuation of the benefit stream. This is the method OMB advocates in its Circular A-94 (1992). According to this philosophy, the returns are compensated based on the likelihood they will be received. Factoring the risk into the discount rate, according to this approach, assumes that the opportunity cost is based on a forgone investment that has the same risk as the accepted program. In reality, this is rarely the case and benefit streams should be adjusted, according to this second approach. Like many of the issues concerning the proper discount rate for the government, there is no consensus on the method of accounting for risk. Regardless of approach, however, risk is an important factor in determining investments and returns and should be included in the analysis in some fashion.

This chapter addresses some of the methods for determining a discount rate that have been proposed in the literature, as well as policies from government agencies, and finally determines the proper government discount rate to use for this thesis. One of the difficulties in finding a discount rate within the scope of this thesis is the theoretical nature of the literature on the subject. The writings of many economists on the subject discuss how the discount rate should be calculated and used, but do not provide a definitive number as guidance. This study of the discount rate compares different values estimated for the discount rate, along with the theory. While there is extensive research on the theory, it is outside the scope of this work to develop a number based on the theory, if a number was not explicitly provided. This made comparing actual values more difficult. The following table summarizes the results from the discount rate discussion:

	Approach	Assumptions	Rate	Year Estimated
1	Consumer Rate of Interest	Opportunity cost of private expenditure	1.5% $\pm$.5%	2004
2	Opportunity Cost of Capital	Opportunity cost of private investment	2%	1997
3	Rate of Return for Treasury Bill	Treasury borrowing rate	10yr life 2.8%	2004
4	Shadow Price of Capital	Calculation based on pre-tax rate of return to capital & discount based on rate of time preference	3%	2004
5	Weighted Average Discount Rate	Weighted average of opportunity cost of private consumption & investment	N/A*	
6	Rate of Time Preference	Opportunity cost of private consumption	N/A*	
7	Opportunity Cost Rate of Return	Opportunity cost of portfolio of unfunded government projects	No exact % but > 10%	1991
8	Pre-tax Rate of Return on Private Investment	Opportunity cost of private investment	4.5% $\pm$.5%	2004
9	Marginal Cost of Funds	Based upon discounting costs, and direct and indirect benefits	N/A*	

Sources: Information provided for this table is from various sources cited in the paragraphs describing each approach

* Specific discount rates were not provided in the literature describing this approach

Table 1. Summary of Government Discount Rate Methodologies

A. METHODOLOGIES AVAILABLE TO CHOOSE A DISCOUNT RATE

In choosing a government discount rate, most methodologies assume that government programs are funded by either reducing investment or consumption in the private sector.

Robert Lind argues that the discount rate should depend on program financing. He argues that government programs vary in their execution and opportunity costs. The

first distinction is the type of funding for the program, investment or consumption. A program funded mostly with reduced consumption must be treated differently than one that involves investment costs and benefits. There are four ways that government spending can be funded. Each form of funding must be evaluated on its own to determine the appropriate discount rate. These forms include funding from increasing taxes, one-to-one changes in the deficit, fixed budgets (addition of one program results in the loss of another), and private sector or other government agency funding. Lind argues that the type (consumption or investment) as well as the source of the funds affects the opportunity cost of capital and is a primary concern in identifying the appropriate discount rate (1990). These different options and combinations should all be evaluated individually.

In addition to determining the funding source for a project (consumption or investment), the time period of the costs and benefits resulting from the project, the effects of international borrowing and the world economy, the crowding out effect resulting from government investment are all important factors in determining the proper discount rate. Another facet of the discussion is uncertainty. In cases where there is uncertainty concerning the actual costs and benefits or if there is large uncertainty about the performance of a project, the discount rate can be increased to account for the uncertainty. Economists with this view believe that although the market determined rate is not a great approximation, it does take into account uncertainty and is better than estimates that do not account for uncertainty (Quirk & Terasawa, 1987).

Two assumptions about how the government makes program decisions also greatly impact the choice of a proper discount rate. One assumption, the marginal project assumption, is that the discount rate should be used to evaluate the next program to fund assuming that the necessary funding will be obtained. The second approach, which is not as widely used, is that the government discount rate should be used to evaluate the portfolio of projects the government should fund given a fixed budget constraint. Using the first method, economists will tend to lower the discount rate. The second method, on the other hand will increase the discount rate. Most of the methodology discussion centers on the marginal project assumption. The exception to this, when the portfolio assumption is used, is the opportunity cost rate of return (Quirk & Terasawa, 1987).

Finally, there are two questions that must be answered in determining the discount rate for use in analysis. What is the conceptual choice of the parameter for the rate, and what is the actual value of the discount rate given the chosen parameters? The following discussion attempts to answer these questions by describing some of the parameters for the rates and including the value derived from these parameters where it was provided.

1. Consumer Rate of Interest

The consumer rate of interest appears to be the best approach when discount rate discussions move from a closed economy to an open world market economy. Based on analysis of opportunity cost of public expenditure related to deficit financing and tax financing it appears that public policy decisions should be made using the consumer rate of interest (Lind, 1990). This method is best suited for the optimal allocation of resources when taxes are considered. The consumer rate of interest is the marginal rate at which individuals are willing to save if their benefits will pay for the present costs (Moore, Boardman, Vining, Weimer, & Greenberg, 2004).

In an environment with no restrictions, the government should invest in all of the projects that have a return that is greater than the consumer rate of interest. Another use for this method is in cases when the relative costs and benefits that come from investment are the same for every period (Moore et al., 2004). The consumer rate of interest is the required return on the purchase of goods individuals need to continue to operate at current levels. In the absence of taxes, the consumer rate of interest would equal and individuals' return on investment.

One problem with the consumer rate of interest is that this method attempts to capture the behavior of individuals. This is very hard to do because individuals act differently in practice than they are supposed to according to the theory. It makes it very difficult to make predictions based on behavior when the behavior is not in line with theory and thus cannot be accurately predicted.

The benefit of using this value for the discount rate is the relative ease in determining the value. Values can be derived from the marketplace using consumer preferences or can be approximated based on Treasury notes, not rates as described below. As a result of its simplicity, this rate is easier to understand when discussed in

analysis, although it may not fully capture all of the variables that affect the discount rate in practice.

According to Moore, et al., there are two possible values for the government discount rate based upon the consumer rate of interest. The first option is the average monthly yield on one-year government Treasury notes. The second option is the average monthly yield on ten-year Treasury bonds. After analyzing these two values in 2004, Moore, et al., estimated the discount rate from the consumer rate of interest to be 1.5% with sensitivity analysis between 1.0 and 2.0% (2004).

2. Opportunity Cost of Capital

Opportunity cost is the value of investments that were foregone as a result of the decisions made concerning current investments. In terms of this analysis, the opportunity cost of capital is the value of the funds that were taken out of the private sector to fund government investments. Using this method for the discount rate captures the fact that the displacement of funds from the private sector for consumption or investment is as important as the actual cost of the project being evaluated. Under this logic, a project should only be accepted if it can earn a benefit that is at least as great as could be earned if the resources were used in another way (Scheraga, 1990).

In order to calculate the opportunity cost of capital you would have to determine the origin of the funds. You would have to know how the funds would have been used to determine the returns that the missed opportunity would have given. Once the missed opportunity is identified, the proper discount rate is the return that this opportunity would have achieved.

There are several issues involved in using the opportunity cost methodology. One issue is an implicit assumption that the funds would be used optimally in the private sector if they are not used in the public sector. Realistically there is no guarantee that the funds would be used optimally in the private sector. The opportunity cost method provides a sufficient hurdle rate in helping to make a decision, but it may result in an overstated requirement for a program to be attractive (Office of the Chief Economist, 1991).

In 1997, Chermak estimated the opportunity cost of capital that has been displaced from the private sector by the government to be about a 2% real rate of return (Chermak, Lowe & Webb, 1997).

3. Treasury Bill Rate of Return

The rate of return for Treasury borrowing provides analysts with a measure of the government's opportunity costs. This rate is more helpful when analyzing funding levels as opposed to real benefits and costs. When evaluating regulatory and public investment, the Treasury rate is normally lower than the pretax return to private capital and could be either higher or lower than the rate of time preference. When evaluating asset divestiture, the Treasury rate provides a bias towards ownership within the government because it assigns a higher value to government ownership of assets than private ownership. This method is best employed when real interest rates are relatively stable and there is a relatively flat yield curve. If this is not the case, using this method should be supported with sensitivity analysis (Office of the Chief Economist, 1991).

The Treasury borrowing rate must be employed with several considerations in mind. First, this rate is better employed if government borrowing does not increase interest rates or override domestic investment in the private sector. Second, analysts must understand that both nominal and real Treasury rates could have large variation over a relatively short time period (several years). When assigning a discount rate, the proper rate must be flexible and vary as well. Analysts and policy makers must understand that the variation in discount rates can change a policy recommendation from one year to the next and must consider the variation in the analysis.

The two alternatives that are considered when using this method are borrowing more or retiring the debt. Private investors have a larger required rate of return because of the risk of default involved in the investment. The public however, should have a risk free rate of return when investing in the government because the government will not default on its debts.

There are also those who criticize the Treasury rate because it does not factor in the costs of taxation and regulation, nor does it take into consideration the social time preference (Lyon, 1990). Another negative trait is that this rate does not factor in risk.

As a result, it favors future projects because the discount rate is understated without a risk factor. This method of discounting also assumes that there is an infinite amount that the government can borrow without affecting market interest rates. It is not practical to make that assumption because the government is not politically permitted to borrow an infinite amount; market rates would increase if significant government borrowing leads to large deficits and debts.

The rate of return for a Treasury Bill can be found in Appendix C of OMB Circular A-94. This appendix is updated on an annual basis with new rates. The following are the real rates for 2004:

3-Year	5-Year	7-Year	10-Year	30-Year
1.6	2.1	2.4	2.8	3.5

4. Shadow Price of Capital

The shadow price of capital involves “compounding a return of capital costs and benefits based on the pre tax rate of return to capital and then discounting both benefits and costs with a rate based on the rate of time preference (Office of the Chief Economist, 1991).” This method has become more popular as analysts understand that one uniform discount rate cannot be used. Instead the rate should be based upon the resources that are used and the life of the evaluated project’s outputs.

The procedure for this method is to discount future benefits at a net rate and then multiply the costs by a scale factor. Finally, analysts using this method must discount the consumption costs at the net rate (Liu, 2003). The Government Accountability Office (GAO)² describes the procedure as compounding a return to capital costs and benefits based on the pretax rate of return and then discounting the costs and benefits by the rate of time preference. The purpose of the two-step process is to account for the two factors of the discount rate, opportunity cost, and rate of time preference (Office of the Chief Economist, 1991).

There are several issues involved in using the shadow price. The first issue is that it is sensitive to incidence of costs, the propensity to save and reinvest as well as the

² The General Accounting Office changed its name to the Government Accountability Office in July 2004. Although this research refers to the Government Accountability Office, most of the discussion is based on previous policies when the agency was named the General Accounting Office. The title Government Accountability Office is used in this research to represent both names (past and present).

opportunity cost and time preference rate assumptions. Even if the shadow price is estimated well, slight variations in any of these factors will result in drastically different numbers (Office of the Chief Economist, 1991). There is little disagreement on the utility of using the shadow price as the discount rate, but the problem occurs in its implementation. Although one procedure has been described above, there is no agreement on a procedure to calculate the shadow price (Liu, 2003). While it is theoretically a good idea, this method of assigning the discount rate is difficult in practice.

One of the major benefits of this method is that it is able to account for funds that come from both consumption and investment (Scheraga, 1990). It is believed that both of these sources provide funding in some fashion. The shadow price is able to capture the total effect on both of these sources. This creates a more thorough discount rate.

Although the theory and methodologies were described in the literature, there was no definitive discussion concerning an exact number. One of the reasons for this is that the number is based on factors that have not been quantified by the government, making actual calculations in practice very difficult. In 2004, Moore, et al., attempted to estimate the discount rate using the shadow price. This attempt resulted in a discount rate of approximately 3% (2004).

5. Weighted Average Discount Rate

The weighted average discount rate addresses the actual use of funds that would occur if there was no public policy interference. Rarely is government funding for a program identified as coming from consumption or investment. As a result, it is difficult to identify a specific discount rate. Lind takes this into account in arguing that the opportunity cost of public spending should be determined using a weighted average of the consumption loan rate and the after-tax rate of return from private investment (1990). Using this approach, analysts are able to take into account factors for consumption as well as investment and provide a more balanced discount rate.

The weights in this method of determining a discount rate are based on the fraction of funds that are used for consumption and investment. The consumption input

into this rate is the weighted rate of time preference; the investment input uses the weighted opportunity cost rate (Office of the Chief Economist, 1991).

One of the weaknesses of this method is that there is no formula or structure for determining the proper weights to use in finding the market returns (OMB, 1992). The weights of each project are unique. This makes it very hard to implement this method and to ensure the values are presented without bias.

As discussed earlier, this method theoretically provides an accurate measure for the government discount rate but is very hard to apply in practice. There is not conclusive evidence of the proper weights to use, and this method requires a project specific calculation for the discount rate. As a result of these factors, there is not a definitive number provided to use in this analysis.

6. Rate of Time Preference

The rate of time preference captures the choices of individuals or the society as a whole concerning current and future consumption. It tries to reflect the rate at which individuals give up present for future consumption. It is best to use this method when government projects will decrease private consumption (Scheraga, 1990). This method provides a hurdle rate of return that must be achieved in investment decisions. This rate only aids in the decision of whether or not to accept a program. It does not provide information to compare a group of programs that have been accepted, and as a result it is not a sufficient analysis tool by itself.

This method is useful in providing a definite number to analyze costs and benefits when used after the shadow price has converted all costs and benefits of a project into consumption units (Scheraga, 1990). An approximation of the real time preference discount rate is the real return of a safe asset, such as government debt.

There are several issues that are identified using this approach. First, it is not always efficient to take money out of the private sector to use in the public sector when the private sector has a higher discount rate. There are instances when this could happen using this discount rate. Second, the rate of time preference is unique to each individual. Issues such as the tax rate and borrowing and investment opportunities could have a

significant impact on the rate of time preference for an individual (Office of the Chief Economist, 1991).

The major advantage of using this approach is that it attempts to represent individual choices concerning current and future consumption. In this way, the government attempts to behave much like the population that it supports. Although it has benefits, a discount rate based on the rate of time preference is difficult to specifically identify. As a result there is not a definitive number to use in this analysis.

7. Rate of Return on a Marginal Project or Opportunity Cost Rate of Return

Quirk and Terasawa argue that the discount rate for government projects should be based on the rates of return of the projects that are not chosen. According to this logic, the government must operate within a fixed budget which is determined by factors which are more complex than economic efficiency. Although the budget is not literally fixed each year, this analysis is useful because the government does not have an unlimited budget. There are certain trade-offs that must be made because not all proposed projects will be funded. Given this budget constraint, efforts should be made to maximize the net benefits of a group of projects given a multi-period fixed budget. The discount rate to be used under this approach is the opportunity costs of the foregone set of projects. Unlike most every other economist researching this topic in 1991, Quirk and Terasawa believe that this method would result in a discount rate that is actually higher than 10%. They believe that OMB should have actually raised their discount rate policy instead of lowering it in 1992 (Hartman, 1990). Finally, they believe that the opportunity cost rate of return should be calculated each year to identify areas of inefficiency and use them to develop a discount rate for the following year (Scheraga, 1990).

Most of the literature on this subject is concerned with the costs and benefits of an additional program investment by the government. This method answers the practical question of what projects are to be funded. Under other methods a large number of projects would meet the criteria for funding, but there would not be enough money to fund all of them. This discount rate approach attempts to find not only which could be funded, but the exact projects that should be funded. Using this discount rate gives policy makers an economic tool and uses analytic reasoning instead of politics to make

decisions. With the opportunity cost rate of return, the discount rate will be the actual opportunity cost to the government instead of simply the return on funds given back to the private sector. Using this method, the discount rate is the rate of return of the group of projects forgone. This cost could be greater than 10% and could exceed the rate that could be earned in the private sector. This method also considers future generations indirectly because the opportunity exists to maximize the outputs given a budget constraint. This method mitigates the intergenerational issue (Quirk & Terasawa, 1991).

According to this method, decision makers are actually trying to find the optimal portfolio of projects that will maximize net benefits. Using this logic, the discount rate should be the opportunity cost rate of return, which is approximated by the internal rate of return from the portfolio of unfunded projects (Quirk & Terasawa, 1991). Lind proposes another possible method for identifying the group of programs to fund given a fixed budget. He suggests that the government use the government's borrowing rate as the discount rate. With this rate, the government can compare projects that are trade-offs for each other based on net benefits (Viltz, 2004).

While this approach's intent seems to be in line with operations within the government, there are several concerns in using this method to find the discount rate. One problem is that although there is not an unlimited money supply for the government, the budgets are not fixed and can be expanded or contracted as necessary. One of the reasons for analyzing projects and budgets is to determine the implications of changing the budget. A second issue with this method is that budgets cannot be accurately predicted further than a couple years into the future. Many of the projects analyzed in cost benefit analysis will extend past the time when a budget can be accurately predicted. This limits the analysis because sufficient data are not available for the full life of longer projects. Another concern is that the opportunity cost rate of return is difficult to calculate. Because there is not a government database of projects and their returns, it is important to construct this database to observe a portfolio of projects instead of looking at each project individually.

There are important traits to Quirk and Terasawa's analysis of the discount rate based on a fixed budget. While this may not be the best measure for long lived projects,

it appears that it provides the closest scenario to the decisions the government faces. Quirk and Terasawa's method for determining the government discount rate in theory appears to be the best approach to analyzing a portfolio of projects. The benefit of this method is that it provides a better approximation for the decisions that the government must make. Although it relies on projections that may not be available, this method's supporters argue that all of the discount rate methods are based on predictions that may not currently be available. This method helps decision makers in determining trade-offs and also helps them to determine funding levels.

When using this method, it appears that the discount rate would be greater than 10%. This approximation is based on Quirk and Terasawa's study where they concluded that the current and predicted future budget conditions have programs that are currently not funded. In 1991, when the study was conducted, OMB was using a discount rate of 10%. Based on this rate and the current situation where there are unfunded projects, Quirk and Terasawa conclude that the opportunity cost of capital must be greater than 10%, although they do not have a specific approximation (1991).

8. Pre-Tax Rate of Return on Private Investment

This approach is best used when government spending decreases the amount of investment opportunities in the private sector. This method is based on the belief that the government funds projects by borrowing, which changes interest rates and reduces investment in the private sector. As a result, the burden of funding government programs falls on private investment rather than consumption, making a weighted average calculation irrelevant. This argument holds true if consumption is not affected by interest rates (Quirk & Terasawa, 1987).

One argument against this method is that it does not include consumption in the analysis. Detractors believe that not all of the funds for public projects come from investment. Some of the lost opportunity likely comes from consumption. If this is the case, the use of the pre-tax rate of return is not a valid method for determining the discount rate (Moore et al., 2004).

Private investments are assumed to involve risk in their required rate of return. Some argue that because of its ability to pool its resources, the government does not carry

the same risk as the private sector. For this reason, the return from private investment may not provide an accurate measure in assessing government programs. This method could be appropriate if the government rate could be based on the private rate from pooled projects. In this case, private investors mitigate their risk much like the government, and a pooled rate could be comparable (Quirk & Terasawa, 1987). Determining the rate of return could be difficult and cost prohibitive, which would make this method less attractive.

The government cannot mitigate all of its risks by simply pooling resources. According to this thought process, the rate of return for private investment, including its risk premium, is the best discount rate for analyzing government programs (Bazelon & Smetters, 1999). Using this rate would make current projects more appealing than future projects because the discount rate would be higher.

There are several numbers that could be used as a basis for estimating the rate of return for private investment. Moore, et al., recommend using the real before-tax rate on corporate bonds. There are two available methods for obtaining an approximation, the monthly average of real yields on Moody's AAA-rated corporate bonds, and the real yield on all of Moody's rated bonds. By using all of the rated bonds for the approximation, the discount rate can be estimated at 4.5% with sensitivity analysis between 4.0 and 5.0% (2004).

9. Marginal Cost of Funds

This approach, discussed by Liu, is based on the premise that costs and benefits should be treated differently, and benefits should be differentiated between direct benefits to consumers and indirect impacts on tax receipts. The focus of this discount rate is on marginal project evaluation. This method attempts to capture the cost of producing one more unit of extra benefit in terms of either consumer benefits or tax receipts. This discount rate captures the method of financing the government will use for a project (labor or capital income taxes) and whether the project should be undertaken given the financing type (Quirk & Terasawa, 1991).

Under this method, projects are represented by a stream of direct costs, direct benefits to consumers and indirect benefits to government tax receipts. Once identified,

the direct costs of different periods are discounted at the gross rate³. The direct benefits are discounted at the net rate⁴. Indirect benefits are used as negative direct costs for the next step of the discount calculation. Before comparing the costs to the benefits, this method requires discounting the present value of the net costs (direct costs less indirect benefits) using a shadow price. Using this method, a project is evaluated by comparing the present value of the net costs with the present value of the direct benefits (Quirk & Terasawa, 1991).

One benefit to the marginal cost of funds approach is that it treats the benefits and costs of programs equally. This allows analysts to view both costs and benefits equally to determine the true outcome of a project. Another benefit to this discounting approach is that it allows decision makers to determine how much they would need to increase the budget to fund a particular program. This could be valuable if budgets can increase to fund additional programs. Finally if decision makers want to fund a program, this rate would help them to determine the amount and source (labor and/or capital taxes) of the funds required for the additional project.

One issue with the marginal cost of funds approach is that it is directly related to the next program to be funded. It does not take into account budget constraints and attempts to evaluate multiple programs that are being proposed. This method of discounting forces analysts to look at a program individually without concern for the other factors surrounding a decision to fund a program. Although it identifies which program should be selected if more funds are available, it does not necessarily provide information concerning the best course of action given a budget.

This approach requires data and calculations that are specific to the programs being evaluated. As a result of the complex nature of determining a discount rate using this method, a definitive number is not provided for this analysis.

³ The gross rate is defined by Liu as the opportunity cost of government revenues.

⁴ The net rate is defined by Liu as the valuation of consumers.

B. DISCOUNT RATE USED BY VARIOUS GOVERNMENT AGENCIES

There are three agencies which oversee government policy analysis. The Government Accountability Office (GAO) ensures that the government is applying best business practices and abiding by laws and regulations. The Congressional Budget Office (CBO) is charged with providing analysis to Congress when requested. Finally, the Office of Management and Budget (OMB) represents the Executive Branch in conducting analysis and making policies concerning financial and budgetary matters. All agencies falling under the Executive Branch must follow the direction of OMB in conducting cost benefit analysis.

1. Government Accountability Office (GAO)

The Government Accountability Office (GAO) implemented its most recent policy on the use of a discount rate in 1991. Its previous policy was to use a rate based on the Treasury borrowing rate for all decisions that involved a discount rate. This rate was based on an average nominal yield of marketable Treasury debt with remaining maturities between one year and the length of the evaluated project. Under its updated policy, GAO analysts are instructed to “use a discount rate of the interest rate for marketable Treasury debt with maturity comparable to the program being evaluated (Office of the Chief Economist, 1991).” The policy further requires that studies include sensitivity analysis to address conflicting opinions on related topics such as inflation, or private sector opportunity costs. GAO’s policy is based upon two major considerations, consistency with basic economic principles, and the feasibility of implementation. The Treasury rate is based on the government’s alternatives of borrowing more or retiring current debt.

GAO further explains its policy and rules for implementation. It requires that analysts use the nominal discount rate for cases when nominal numbers are provided. When real numbers are provided, the GAO policy requires that analysts consider the inflation rate using a projection from an independent forecasting firm. To determine the real rates, GAO analysts are instructed to subtract the projected inflation rate from the nominal interest rate. It further requires sensitivity analysis when there is uncertainty about the appropriate values to use, such as cases dealing with inflation (Office of the

Chief Economist, 1991). Finally, the GAO's policy is simplistic in terms of maintaining the same policy of discounting regardless of the type of analysis.

There are several strengths in the GAO policy of using marketable Treasury debt as a discount rate. The first strength of the policy is its simplicity. This simplicity makes it easy to incorporate into analyses. There is a smaller amount of information and research required than in other methods of computing the discount rate. The simplicity also makes the results of the study easy to understand and use in setting policies. The discount rate is used by GAO to identify and analyze different uses for government investments and resources. The policy is in line with this purpose because it is based on Treasury debt resulting from previous government expenditures. This policy also provides uniform analyses throughout GAO. Because the policy does not have significant opportunities for varying interpretations, GAO can be confident that the analyses that it conducts are not biased by manipulating the discount rate.

There are also several weaknesses of the GAO's policy. GAO's discount rate is not directly related to the costs and benefits of the private sector. Most government investments have an impact on private citizens, the impact of government actions on the private sector are not captured using GAO's discounting policy. There is a large amount of variability involved in the Treasury rate. As a result, it will be difficult to compare studies conducted previously because those studies could have different results depending on the change in the discount rate. This also becomes a problem for analyses that will extend for many years in the future. GAO's policy provides a discount rate that is the same regardless of the decision that is analyzed. This creates a rigid number that does not depend on the project; this is different from many of the other theories on the proper discount rate. This rigidity could impact the perceived favorability of a program when a different rate should be applied for the specific circumstance. The GAO policy for discounting is intentionally simple; as a result there are several issues that limit the accuracy of GAO analyses compared to other methods of determining the discount rate.

The GAO policy provides a framework for a simplified analysis of discounting costs and benefits. Although there are several limitations to this policy, GAO accepts the controversial nature of the discount rate discussion and mitigates these policy weaknesses

by emphasizing sensitivity analysis. According to the policy, “the Treasury rate itself, as discussed earlier, will often be an imperfect proxy for an ideal discount rate. Additional emphasis on sensitivity analysis is likely to be more useful than averaging yields of different maturities at a single point in time (Office of the Chief Economist, 1991).” The goal is to provide a baseline of information for discussion and policy making. GAO is aware that its current policy may not be the best approach in all cases, and emphasizes sensitivity analysis in all cases especially when its approach is not optimal.

2. Congressional Budget Office (CBO)

There is not a published policy on the discount rate to be used by the Congressional Budget Office (CBO). After interviewing several analysts in the agency, including those in the macroeconomic department, the conclusion is that the discount rate issue is still a hotly debated topic. The analyst interviewed, John Peterson, commented in a phone conversation that when the discount rate is a principle factor of analyses, the personnel who are conducting the research develop the specific policy to use in the study. (2004). Although there is not a primary source for the CBO policy, there was literature that described CBO methods of using the discount rate to conduct cost benefit analysis.

CBO has a policy in which the discount rate used is based on the real yield of the Treasury debt. The discount rate based on this policy is estimated at 2%. The policy also requires that analyses include a sensitivity analysis of plus or minus 2%. By conducting sensitivity analysis, CBO hopes to capture the scope of variability of real yields.

In the 1980s, there was a large government budget deficit. As a result, the government had to borrow from abroad. With this in mind, CBO studies confirmed that the discount rate should be the government borrowing rate abroad. Using this thought process, the appropriate discount rate is the government borrowing rate. This rate serves as the borrowing rate abroad because exchange rate risk is already built into the developed rate (Hartman, 1990).

Studies continue to search for the best discount rate approach. Analysts within CBO realize that communicating within the agency was difficult because there was not a common language, especially in terms of a discount rate. After conducting research, CBO appeared to settle on a policy of using 2% real as the government discount rate,

which is the yield on government securities. The policy further suggested using sensitivity analysis of $\pm 2\%$ points around the chosen rate. The range of discount rates to be used for analyses ranged from 0-4% real. After gaining confidence that the chosen rate would have limited variability, CBO began to use the policy for analyses in the mid-1980s (Hartman, 1990). This policy helped convert future benefits into present values to determine the appropriate level of spending for a project. One exception to this policy is for valuing assets such as loans made by the federal government; CBO recommends using private-sector discount rates (Lyon, 1990).

One of the problems with using a rate that is so low (other than the exception above) is that the private sector will almost definitely use a rate that is higher; this will cause projects to be valued more favorably than the private sector. There is also no factor included in the discount rate for risk. For these reasons, CBO continued to look for an appropriate discount rate, and considered using market rates which provided some flexibility (Hartman, 1990).

There is no definitive information concerning CBO's policy for discounting. The biggest disadvantage with a lack of a uniform policy is that studies may contain a bias. The lack of a policy also makes it difficult to compare studies and communicate within the agency. An advantage of the lack of control over a policy is that analysts can use the information directly related to the study they are conducting to develop the discount rate that best captures the situation in the study. Although there is not a policy directly from CBO, the literature indicates that the apparent discount rate used is 2% real with sensitivity analysis from 0-4%.

3. Office of Management and Budget (OMB)

The Office of Management and Budget (OMB) created a policy in 1972 (OMB Circular A-94) for all Executive agencies to use a discount rate of 10% in cost benefit analysis. The basis for this decision is the opportunity cost of capital expressed as the before-tax rate of return on private investment. This discount rate was generally regarded as being too high. In the early 1990s, OMB conducted extensive research into the proper discount rate. That research resulted in the current policy which was adopted in 1992. The current policy mandates that Executive agencies use a discount rate that is largely based upon the Treasury rate. The policy also allows for flexibility depending on the

type of issue that is being analyzed. It further allows agencies to use a different rate when it is interpreted to provide a better analysis. The use of a different discount rate method must be approved by OMB before it can be incorporated into the analysis.

OMB's policy of 10% real rate for the discount rate in analysis remained for twenty years. This was partly because there was little convincing evidence for or investigation into a different method or rate. While it is apparent that this discount rate was not the perfect rate to use, it was also apparent that it provided sufficient information for cost benefit analysis. This was especially true when comparing two or more projects for acceptance. In this case, the discount rate is uniform and the projects are compared based on their individual merits instead of the results being manipulated by the use of different discount rates.

There were four exceptions to the 1972 guideline for using a 10% discount rate. The first exception allowed for instances when a different discount rate is justified, although they did not specify what accepted justifications were. Second, for lease-purchase decisions OMB determined the Treasury borrowing rate was most appropriate. The third exception was water project investments, in which the Treasury rate should be used. Finally, in cases of asset divestitures OMB approved using market interest rates for comparable private-sector projects (Lyon, 1990).

In 1992, OMB revised its Circular A-94 and changed its discount rate policy. This guidance applied to analysis of programs that extended for three or more years. The new policy added more guidance on the proper discount rate to use for agencies conducting specific analyses. The general effect of the new policy was to lower the discount rate.

In the discussion of the proper discount rate, OMB states that costs of a project should include the opportunity costs of any resources used. This opportunity cost should be measured in terms of the return the resources could achieve in their most productive use. OMB incorporated this idea into their analysis and ultimately into the determination of their final discount rate policy (1992).

OMB also discusses inflation in their recommendation. They concluded that the inflation rate was uncertain and, as a result, analysts should avoid incorporating inflation

in the discount rate if possible. If inflation must be incorporated, OMB advises using the Administration's economic assumptions for the period of analysis. These assumptions are based on private sector forecasts and are acceptable for sensitivity analysis (1992).

The 1992 revision included a discussion of two types of discount rates. The first rate should be used for public investment and regulatory analysis. The proper discount rate to use in these circumstances is the approximation of the marginal pre-tax rate of return on average private sector investments. The discount rate resulting from this method is 7% (Zerbe, Han, Layton, & Leshine, 2002). The second set of circumstances includes cost-effectiveness, lease-purchase, internal government investment and asset sale analysis. When conducting analysis in these situations, OMB recommends using a discount rate based on interest rates of Treasury notes and bonds with maturities ranging from three to thirty years, depending on the life of the project. OMB provides an update of the Treasury rates annually for use in these types of analyses. These updates are based on the Administration's assumptions concerning the budget (Zerbe et al., 2002).

There are several concerns related to using the Treasury rate for long term decisions. According to Goldberg, the Treasury rate is the correct rate to use for analyses lasting two periods. He argues that the Treasury rate is not appropriate for analyses that span longer than two periods (years). According to the argument, the Treasury rate will provide different results if there is fluctuation in the marginal interest rate over the three periods. When rates fluctuate, there is a possibility to reinvest some of the proceeds to take advantage of the changes. When using the Treasury rates, analysts cannot account for the reinvestment and could evaluate programs incorrectly (1998).

OMB understands that there is still not a consensus on the proper discount rate to use for government programs. As a result, it encourages analysts to look at other effectiveness measures than strictly net present value analysis. According to OMB, this will provide a more rounded analysis and support the findings of the analysis using the discount rate. It further recommends analyzing and reporting uncertainties that were encountered in the analysis. Finally, it highly recommends using sensitivity analysis to incorporate the acceptable range of values for important variables that cannot be precisely identified.

Current discount rates to use in internal cost benefit analysis studies can be found in Appendix C of OMB Circular A-94. These rates are updated annually based upon the Executive branches estimates of the future economic outlook.

C. RATES USED IN COMPARABLE STUDIES

As part of the discount analysis, a sample of cost benefit type research, mainly from the Naval Postgraduate School (NPS), was observed. The purpose of the observation was to identify discount rates that have been used in prior analysis. The sample includes seven studies. The studies were from Fuchs (2000), Brown (2003), Arceneaux (1997), Sewell (1994), Rogge (1996), Martucci (2000), and Giarizzo (1993). All of the studies were conducted after 1992, in order to account for the change in OMB's policy concerning the discount rate appropriate for Executive agencies. This is not a large sample and is not intended to be statistically significant in nature. The main purpose is to obtain an idea about what other postgraduate students were using in their research of the costs and benefits of government programs. The following table summarizes the observations:

Researcher	Title of Research or Article	Publication Year	Discount Rate
Fuchs	Cost Benefit Analysis of Alternatives to the NROTC Flight Physical Screening Process	2000	7%
Brown	Cost Benfit Analysis of the Department of Navy's F-5 Tiger II Contract	2003	7%
Arceneaux	Cost Benefit Analysis of Leasing vs. Purchasing Computers	1997	7.30%
Sewell	An Analysis of Enlisted Early Separations Under the Air Force's and Navy's VSI/SSB Programs: a Comparative Study	1994	7%
Rogge	An Analysis of the Separation Bonus (VSI/SSB) Program Using the Annualized Cost of Leaving Model	1996	10%
Martucci	Cost Benefit Analysis for US Navy's Closed Circuit Television System	2000	3.70%
Giarrizzo	An Analysis of Enlisted Early Separations Under the Navy's VSI/SSB Program: the Impact of Eligibility and Program Benefits	1993	7%

Sources: Information provided for this table is from various sources cited in the previous paragraphs

Table 2. Summary of Observed Cost Benefit Analyses

After reviewing the studies it is apparent that most cost benefit analyses conducted use OMB Circular A-94 as guidance. The majority of the studies used a 7% discount rate. Other studies used a lower 3% rate, which was based on the Treasury borrowing rates suggested by OMB. After observing the discount rates employed in these studies, it is apparent that OMB Circular A-94 is widely used. The trend of using OMB's rate is not surprising because it oversees analysis in the Department of Defense. It appears from looking at these studies, however, that the discount rate was not a major concern. The basis for this argument is that no studies included sensitivity analysis in their choice of a discount rate, as recommended by OMB. The conclusion from observing the sample of NPS research is that analysts understand that the discount rate must be included as a variable in the study when computing present value. Although the number must be included, it does not appear that its importance is given significant weight in these studies, especially because they do not include sensitivity analysis.

D. DISCOUNT RATE USED TO CONDUCT ANALYSIS IN THIS STUDY

According to Lind, cost benefit analysis in the government should use the government's borrowing rate as the discount rate for most projects. He also believes that analysts should calculate the breakeven rate, and use sensitivity analysis to ensure a thorough study. Finally, Lind believes that each agency should maintain a database of projects and their cost benefit studies to use historical actions to formulate the best discount rate for the future (1990).

When determining the appropriate discount rate to use in the analysis of early separation incentives, several conclusions emerge from the research on different methods of discounting:

1. Opportunity cost must be an essential element in the discount rate. Opportunity cost appears to be one of the most significant variables because it is a true evaluation of an alternative use of funding.

2. Although government budgets are not fixed in a literal sense, there is a great deal of trade off that must be made in creating budgets and deciding on projects. The result of this observation is that the idea of the opportunity cost rate of return must be included in the decision of a discount rate. Factoring this idea into the decision should provide a higher discount rate than other methods would have suggested.

3. Sensitivity analysis is necessary. The uncertainty involved in this discussion almost makes it mandatory. Including sensitivity analysis in the study will provide a better range of possible discount rates and will make the study more acceptable. It has been impossible so far to identify one correct discount rate for the government. Including sensitivity analysis confronts this problem and attempts to mitigate it.

4. One option is to use the federal borrowing rate to maintain simplicity and provide for numbers that can be used and understood by policy makers. This approach appears to be too simplistic and undermines the importance of the discount rate in cost benefit analysis.

5. Analysts must identify the discount rate before the analysis is conducted to avoid the opportunity for analysts to manipulate results based on the discount rate. If the

decision is put off until after the numbers are included in the analysis, there is the potential for analysts to manipulate the discount rate to change the appearance of projects.

6. Having a uniform discount rate may not be appropriate for every project. There are instances where one method is more desirable than another. It is impractical and nearly impossible to develop a discount rate that can be applied to the wide variety of decisions required in the government. The other extreme of having a project specific discount rate is not necessarily the proper approach either. This approach would increase the problems of manipulation and make it hard to compare the costs and benefits of different programs to make policy decisions.

7. It is important to follow OMB's policy because this is an analysis of a Department of Defense project. It is important to have OMB's policy factor heavily in the proper rate, but given the research, using this method would simplify and marginalize the importance of the discount rate as well. When deciding on the proper rate, however, OMB's reasons for the rate chosen should play a major part.

After conducting research on all possible methods of choosing a discount rate, the opportunity cost rate of return method appears to be the best choice to use as a discount rate. I believe that the savings that could be possible from early separations would result in a reallocation of funds to allow for other government projects. In this case, the Treasury rate of return seems to be too low of an approximation. The savings from the separation programs would not necessarily fund one more project, but likely a portfolio of projects, which is why Quirk and Terasawa's method seems to be appropriate. Using this discount rate will also imply a government rate that is a closer approximation to the apparent personal discount rate, which will be discussed in a following chapter. The problem with this method is that there is not an exact value for the discount rate. The other problem with this rate is that it is much higher than OMB's current policy. Given these issues, the discount rate for this thesis will be 10% real rate with sensitivity analysis of $\pm 3\%$. By using this discount rate, the study attempts to approximate the opportunity cost rate of return and provides sensitivity analysis to allow for some error and provide a more comprehensive analysis.

THIS PAGE INTENTIONALLY LEFT BLANK

V. INDIVIDUAL DECISION MAKING

The personal discount rate has implications for how personnel make monetary decisions such as accepting a voluntary separation incentive. Just as the discount rate is important for the government, the personal discount rate is important for an individual when making a future value decision. Often this rate is not explicitly known to individuals, but it can be approximated by observing their financial behavior. Also like the government discount rate, the personal discount rate is widely discussed with limited consensus on the proper rate to use. Some results of previous studies concerning the personal discount rate are discussed in the following sections of this chapter as well as other issues affecting personal decisions.

A. INDICATIONS OF PERSONAL DISCOUNT RATE FROM PREVIOUS DECISIONS

Many analysts were surprised by the results from the drawdown of the 1990s. The majority of individuals who chose to accept the early separation incentive chose the lump sum (SSB) option. This choice was made even though the annuity (VSI) option seemed to be more lucrative. The selection of lump sum was even more surprising given that training was provided to help personnel understand the payments and the value of each option. This information included comparisons of lump sum and the present value of annuities. Using a 7% nominal rate in the explanation, these pamphlets clearly demonstrated the value of the annuity over the lump sum. Even after receiving information about the advantage of the annuity, 92% of enlisted personnel and 51% of officers who chose to separate early opted for the lump sum over the annuity (Krueger, 2001). Warner and Pleeter conducted an analysis on military personnel's selection of the incentives for 1992. Their analysis concluded that the break even discount rate between the VSI and SSB was between 17% and 20% depending on rank and years of service (2001).

In their background study of the research concerning the personal discount rate, Warner and Pleeter developed three general observations. First, it is apparent that individuals act differently and no two individuals discount future values at the same rate.

According to their research of various experiments and studies, it appeared that most individuals discount future cash flows at a rate between 10% and 25%. They attributed the range to the fact that individuals appear to discount at a lower rate for large sums of money (2001). Secondly, they concluded that the discount rate varies with time. According to their research, individuals discount future flows for longer time horizons at a lower discount rate. Finally, they concluded that the personal discount rate varies with individual characteristics, such as income and education. Along these lines, they also noted that personnel who were more likely to separate were more likely to accept the lump sum (2001). Based on this data, it appears that lower quality performers were likely to accept lump sum separation incentives which provided the military with increased savings in the long run.

In their analysis of the incentive programs for all services except the Marine Corps, Warner and Pleeter discovered that those that were more likely to separate chose the lump sum payment over the annuity. They also noted that, among officers, those with graduate level education have a lower discount rate by approximately .75 percentage points. They also found that the preference to select the lump sum payment increases with the number of dependents, but is lower for older individuals. Finally, Warner and Pleeter observed that discount rates severely decline depending on the sum of money. For each increase of \$10,000 for the lump sum, the discount rate was observed to decline by .5 percentage points. Based on their analysis, Warner and Pleeter concluded that the break even discount rate was approximately 17% and the real personal discount rate was approximately 16% to 23% for officers in the study (2001).

GAO published a study in 1985 based upon reenlistment bonuses. The findings of this study were consistent with the findings of Warner and Pleeter. One conclusion is that younger personnel have a high time value of money. They value money received today much higher than money that will be received in the future. The study also cited research by the Center for Naval Analysis which determined that the discount rate for enlisted sailors accepting bonuses was approximately 17% (General Accounting Office, 1985). Much like the separation incentive, this study was based upon individuals' choices to accept a lump sum payment instead of an annuity bonus.

The personal discount rate provides insight into the decision making of individuals. When evaluating what separation rate is appropriate, it is important to consider the personal discount rates of the target group. This rate is not simple to calculate or observe and is unique to each individual. By understanding this rate, the Navy will be better able to set incentive amounts and possibly change the method for offering the incentive. Based upon studies from past behavior it appears that the personal discount rate for individuals deciding on early separation incentives is approximately 14%-25%. The following sections discuss some of the important factors for individuals making separation decisions. The discussion of these sections involves the imputed discount rate. Most of the issues below do not change the actual discount rate, but lead to a misspecification of the observed discount rate because some costs and benefits are misinterpreted.

B. ESTIMATE OF CIVILIAN SECTOR WAGES

The civilian job market is a major factor in the decision to voluntarily separate from active duty. If personnel believe that they will be more successful in the civilian job market than on active duty, they will be more willing to separate. Similarly, if they believe that they can earn more money in the civilian market they will be more willing to separate. Conversely, if the civilian job market is not favorable and options appear to be limited, personnel will be less likely to separate from active duty. The civilian job market is an important factor in the voluntary separation decision and as a result must be factored into the valuation of a separation incentive for military personnel.

The civilian job market could also have an impact on the personal discount rate based on perceived ability to succeed in the civilian sector. If service members believe that they are marketable in the civilian job sector, their personal discount rate will appear higher based on their decision to accept a separation bonus. The apparent higher discount rate would be a function of other factors involved in the separation instead of purely a financial decision about the incentive. In this case, personnel would require a lower rate of return from the separation bonus because of the expectation that they will be marketable and find a sufficient income stream in the civilian job market.

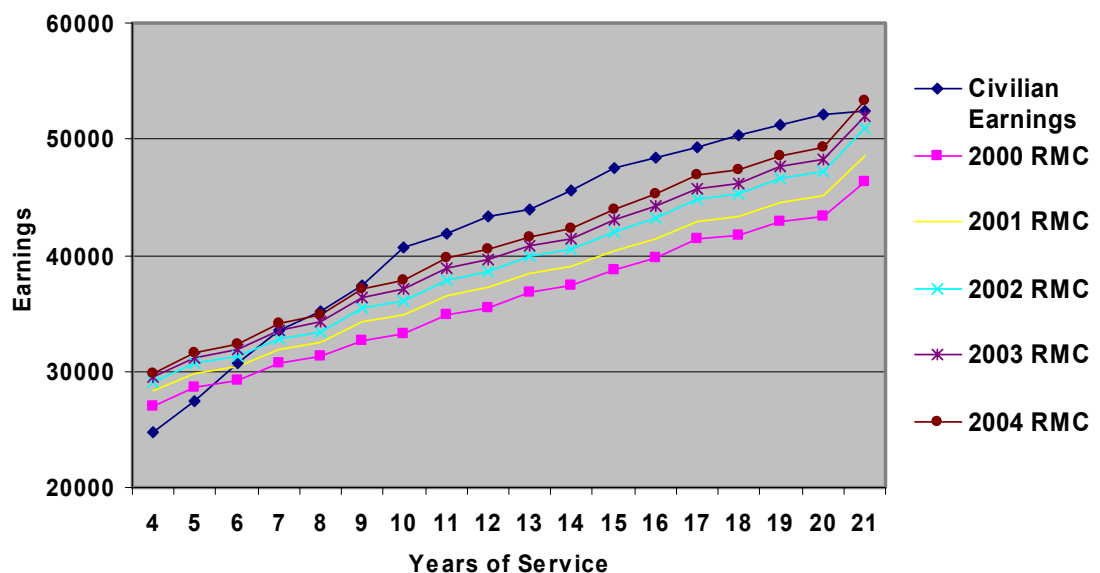
The discussion concerning comparable civilian wages could also be based upon hourly wages. According to a recent Navy Times article, personnel average about 50-55 hours of work per week on active duty. This is for non-combat related job performance. Those individuals in a combat zone work about 90 hours a week. Although the military does not base its pay system on hourly figures, these figures provide personnel with a rough idea about how their pay would translate into civilian wages. The military does not compensate for overtime in its pay structure. The computed hourly wages tend to be lower for military personnel as a result of the increased hours of work per week and lack of overtime (the typical civilian works a 40 hour week) (Crawley, 2004). Sailors interviewed in the article were not concerned with the lack of pay they received on an hourly basis. Although comparable civilian jobs may provide compensation greater than the military, most sailors are not complaining and understand the benefits they receive on active duty. With the proper early separation incentive, however, those most adversely affected by military work hours may entertain the idea of leaving the military for civilian jobs.

When individuals choose to separate from active duty, they often undervalue the benefit of military compensation and benefits. They anticipate higher earnings in the civilian sector (Healy, 1992). This can lead to an increase in separations and a higher imputed discount rate in cases when a separation incentive is offered. Often, however, officers are disappointed when they enter the civilian work force. They lose responsibility and status when they enter the job force and have to build their reputation to advance in the organization. Personnel deciding to separate must ensure they have done research and have an accurate picture about their future in the civilian sector. If they are informed, it reduces their risk and will most likely imply a lower imputed personal discount rate. This is often not the case. According to Melissa Healy, “many other officers often have unrealistic expectations about how quickly they will be offered jobs, what kind of salaries they can command and how much responsibility they will be given in their first jobs outside the military (1992).”

It is very hard to capture the actual amount of pay individuals could expect to receive in the civilian sector. One reason is many of the military skills do not transfer easily to the civilian work force. This is especially true with combat arms specialties.

Another reason is that personnel are constantly changing jobs in the military. Although individuals have specialties they are often used to fill holes by doing jobs outside of their specialty. Although leadership experience is most likely involved in the job especially for officers, this experience is hard to capture because it cannot easily be converted into a comparable civilian sector job description. According to Saul Pleeter in his presentation to the Senior Enlisted Advisors Conference, military wages for enlisted members with some college education are higher than civilian wages until approximately eight years of service. After eight years of service, civilian compensation is higher than military compensation and the gap continues to widen until about 20 years of service (2004).

Figure 1. Comparison of Military Members' Regular Military Compensation with Civilian Earnings with Some College Education: 2000-2004 (From Pleeter, 2004)



This provides a description of compensation trends for military decision makers to use even if they do not have exact numbers. Understanding this trend and the relative compensation of military to civilian will allow the Navy to develop proper levels of competitive compensation and will also help in determining the proper separation incentive to offer in the future.

C. OTHER CONSIDERATIONS CONCERNING SEPARATION DECISIONS

Studies have shown that non-financial factors outweigh financial benefits in making the decision to separate from military duty. Often this occurs because the military pay system is complex and personnel do not realize the full financial benefit they receive compared to the civilian sector (Sewell, 1994).

1. Knowledge

Individuals do not always know where they stand in terms of career progression. It would be hard for individuals to make a decision concerning early separations without information on potential advancement or civilian career opportunities. Individuals often do not have this information, or it is not accurate. As a result, individuals make decisions based upon their perception of the situation. These perceptions play a role in the imputed personal discount rate as well. Personnel who are unsure about their potential civilian job prospects will likely want to remain on active duty. These individuals will require a greater separation incentive to compensate them for the potential risk of moving into the unknown civilian job market. On the other hand, individuals may be unsure about their opportunities in the Navy. For these individuals the separation incentive does not have to be as high.

Paying an incentive provides an opportunity to mitigate the risk and uncertainty of leaving active duty. Individuals who lack knowledge concerning their future possibilities in the military or the private sector have higher uncertainty. This uncertainty creates risk of an incorrect decision based on inaccurate assumptions rather than facts. These personnel require a larger incentive to compensate them for the risk burden. Although it is hard to assess the specific knowledge base for each individual's decision, understanding potential opportunities is critical when evaluating the personal discount rate.

Knowledge is also important concerning the true cost of all the personal benefits received on active duty. If the amount deposited in an individual's checking account is what is regarded as pay and benefits, the individual underestimates the value of the military pay and benefits system. In the Navy Times article titled "Cheap Labor," a 2nd Class Petty Officer is interviewed. His comment concerning knowledge about military pay and benefits could help explain a high imputed discount rate when making a decision

about early separation. This decision could be the result of thinking that individuals can earn more money in the civilian sector. According to the Petty Officer, “It was the benefits that brought me back. To most of the Navy they’re invisible. (Crawley, 2004).” If individuals do not fully comprehend all of the benefits the military provides, they will most likely undervalue their compensation compared to the civilian sector, and will appear to use a higher personal discount rate to make their decision concerning early separation incentives.

2. Job Security

Another factor that could contribute to personnel deciding to voluntarily separate is job security. In normal periods the military provides a secure job environment. As a result, personnel would be more likely to remain on active duty for job security. With the focus on downsizing the force, however, personnel may not feel as secure in their military job. As a result, they may look to separate while they have the ability to receive a payment. This would tend to be more apparent for lower performers who feel that they have poor chances for advancement and are anxious about the possibility of involuntarily separating.

If personnel feel that they have a good chance of advancement, or at least the ability to remain on active duty until retirement, they may be more likely to decline the incentive. This would be especially true if the civilian job market is in a down time and the probability for security in the civilian sector is low. As discussed in the previous section, knowledge and assumptions will most likely determine how much job security affects the imputed personal discount rate.

3. Age

Another factor which may affect personal preferences and the imputed discount rate, is age. As officers increase in age, their opportunities for outside employment decrease. Civilian employers are not willing to train personnel for new skills if they do not believe that individuals will remain with the company for an extended period of time. Officers who will retire at an older age may be more likely to accept the early separation offer to start a new career in the private sector at a younger age. Younger officers, on the other hand, may not be concerned about their age for civilian employment opportunities. These individuals are currently young enough to be marketable in the private sector if

they accept the early separation incentive. They will also be young enough to compete in the private sector if they decide to remain on active duty and retire. Age may be a factor for individuals deciding to accept the incentive. Older individuals may view the early separation incentive as a way to obtain some compensation and start a second career while they are still competitive. These individuals will have a higher imputed discount rate than younger officers would in making the early separation decision.

4. Motivation

Motivation plays a role in individual decisions to accept early separation incentives. About half of the officers that accepted the offer in the 1990s would have separated from active duty without the incentive. For these officers, the incentive is an extra payment. They did not have to be compensated to leave, they would have left voluntarily. These make the personal discount rate appear higher than it is. They were not expecting the incentive. When it was offered they may have decided that they could do more with a large amount presently than annuity payments in the future. For officers in this case, their decision did not involve the early separation incentive so it became extra money. Any incentive would be more valuable to these individuals. By accepting the lump sum they may have inflated the personal discount rate observed by Warner and Pleeter.

The Navy must develop a mechanism to eliminate payments to those individuals who would have separated without the incentive. As discussed in a following chapter, these economic rents affect the savings the Navy achieves. Although it is beyond the scope of this research, a potential area for further research would involve decreasing incentives given to individuals who have already decided to separate. A potential resolution to this issue would be to offer a variable incentive as opposed to one policy for all personnel.

D. IMPLICATIONS FOR FUTURE EARLY SEPARATION INCENTIVES

It is important to understand the point of view of individuals making early separation decisions. By understanding personal discount rates and the rationale behind them, the Navy can provide more effective early separation incentives. One consideration in determining the proper incentive is financial. The Navy must provide an

incentive that will entice the desired level of separations. This is one of many considerations for individuals, however. To best set early separation policies, the Navy must understand its personnel and the issues that are most important in their decision. By understanding these issues, the Navy will be able to drawdown the force while maintaining quality in the officers it retains. It will also ensure that the incentive is not too enticing. If this is the case, it creates more volunteers for separation than the Navy can afford to lose. This will increase the effort for the Navy to determine who to retain and who to separate and could have a negative effect on morale. It could also negatively influence the performance of those officers it chooses to retain, reducing quality in the force.

By using the past policy as an educational tool, the Navy should be able to provide a more effective program in the future. While in some cases it is not important how individuals perform after separation, and what caused them to accept the incentive, this is a short sighted view. If the Navy understands the background factors leading to the decision, it will be able to provide an incentive that will save money and benefit individuals. It is also important to understand that each individual is different. It is impossible to accurately predict what individuals will decide. By learning from past experiences, the Navy can make informed decisions leading to an efficient drawdown, achieving its quantity, quality, and cost savings goals.

Although it is very difficult to derive a single rate for the personal discount rate, and individuals are different, it is important to identify the issues surrounding this rate to help in formulating the proper separation incentive. By understanding a range of possible personal discount rates, the Navy will be better equipped to offer early separation incentives to meet its goals efficiently and effectively.

THIS PAGE INTENTIONALLY LEFT BLANK

VI. DATA AND METHODOLOGY

This section presents the data used to create the early separation incentive model. The model's intent is to observe "average" officers in the Navy from all specialties. While the model could be used to specifically target individuals from a specific warfare community, this was not the intent when the model was created. The section describes the data and its use in the model. Finally, it discusses the assumptions made about the data and the behavior of Naval officers.

The target group for the analysis is officers currently in the grades of Lieutenant (O-3) to Commander (O-5). This was the target population when the Navy implemented its drawdown policies in the 1990s. This would most likely be the target population if the Navy decided to make a total force drawdown in the future. Those officers more junior than Lieutenant (O-3) do not have enough service time to be eligible for the programs if they were commissioned without enlisted service. Officers who have prior enlisted experience are not likely to separate before they are promoted to Lieutenant (O-3). In order to be promoted to Captain (O-6), an officer will have approximately 22 years of commissioned service. Therefore, captains (O-6) and above, are already eligible for retirement and the early separation incentive would not apply (All Hands, 1997). The maximum current rank in the model is Commander (O-5).

The model was created using Excel and the Crystal Ball add-in. The Crystal Ball add-in provides distribution functions for several variables within the model. These distributions were used to calculate a range of values during Monte Carlo simulations.

The model captures individual data concerning pay grade, age, years of enlisted service, discount rate, and total years of service to provide the expected present value of retirement payments. The model uses the input values as well as a promotion decision tree to determine the retirement pay grade and the life expectancy of the officer. The following sections discuss the methodology and variables used in the model.

A. BASIC PAY

Basic pay is the foundation for determining future financial benefits for military retirees and is the basis of the cost to the Navy for retired personnel. The model uses the 2005 basic pay charts for its calculation (Maze, 2004). This chart is provided in Appendix B. The assumption concerning basic pay increases is that the long run increases will be consistent with inflation. Although we are predicting retirement payments into the future when pay raises will occur, these raises will not affect the analysis if future raises don't affect real pay.

The basic pay charts express monthly values. These values were converted to annual salaries to compute the annuity provided to retirees. The computed annual base pay amounts form the basis for retirement annuity calculations in the model.

B. RANK

Rank is another fundamental variable in this model. Rank in the Navy largely determines the basic pay officers receive. It also indicates the probable age and years of service for an officer. In the model, rank is used for all of these purposes. The model identifies current rank as well as retired rank. The current rank is an input into the model prior to running a simulation or making a calculation. The initial VSI/SSB policy targeted officers in ranks O-3 to O-5. The model observes only these three ranks. Retired rank is variable in the model. This rank is based upon the current rank and the promotion and retention probabilities described below in Section C. The potential retirement ranks include Lieutenant (O-3) to Captain (O-6). Officers are not permitted to retire prior to reaching Lieutenant (O-3). The model assumes that the Navy will not target officers for early separation that are motivated to attain a rank above Captain (O-6). It also assumes that officers considering early separation will not remain on active service to compete for Admiral (O-7). As a result, the highest current rank observed is Commander (O-5) and the highest retirement rank in the model is Captain (O-6).

C. PROMOTION AND RETENTION RATES

To determine individuals' possible retirement rank, the probability of promotion to each rank is computed in the model. The model captures promotions to Lieutenant

Commander (O-4), Commander (O-5) and Captain (O-6). The model assumes that those officers thinking about early separation do not aspire to ascend to the rank of Admiral (O-7).

The chance that an officer will be passed over for promotion is also included in the model. The Navy uses the term Failure of Selection (FOS) for those officers that were passed over for promotion. Currently, officers have two chances for selection to the next rank. After being passed over the second time, officers will either separate or be permitted by a continuation board to remain on active duty in their current rank until they become eligible for retirement. Although there are exceptions, the continuation board only approves continuations for officers that have at least 18 years of service.

The probability of a Lieutenant (O-3) or Lieutenant Commander (O-4) remaining on active duty was also factored into this model. The model assumes that officers who have attained a rank of Commander (O-5) are close to 20 years, the minimum service required for retirement. Officers in this category are assumed to remain on active duty until retirement. A decision tree was used to capture the probabilities for promotion as well as the retention probabilities (Appendix C). Crystal Ball was used to incorporate a distribution of promotion probabilities and separation probabilities during the Monte Carlo simulations.

The following ranges of probabilities for promotion, based on documentation from an All Hands publication were used in the model⁵ (1997):

Lieutenant Commander (O-4):	70-90%
Commander (O-5)	60-80%
Captain (O-6)	40-60%

The following ranges of retention probabilities were used in the model:

Lieutenant (O-3):	72-88%
Lieutenant Commander (O-4):	85-95%

⁵ Appendix D provides model distributions for promotion and retention probabilities

D. YEARS OF SERVICE AT RETIRMENT

It was also important to consider the years of service officers have when they retire from active duty. Years of retired service, combined with current years of total service and current age, determine the age when an officer retires. This value also determines the basic pay amount to use for calculating the maximum the government should be willing to pay an officer to separate early. The ranges for years of service at retirement were determined based upon when officers were eligible for retirement and the maximum amount of service allowed for specific ranks (All Hands, 1997). This input will provide the model with information to determine the life expectancies of officers when they retire. The ranges for years of service at retirement are⁶:

Lieutenant (O-3):	20 years
Lieutenant Commander (O-4):	20-24 years
Commander (O-5):	20-28 years
Captain (O-6):	24-30 years

E. AGE

The age variable captures officers' present ages. This is the age when they are hypothetically making the early separation decision. As discussed in Chapter V, age could have an effect on officers' decisions to separate from the service before retirement. Current age contributes to the model by determining, with other factors, the age at which officers retire. The age when officers retire determines their life expectancy after retirement. Rank requirements and years of enlisted service were factors in determining the range of current ages. The model assumes that officers with enlisted service could not have joined active duty until they were 18. The model also assumes that officers with no prior enlisted experience could not have entered active duty until they were 22 (4 years of college starting at 18). The ranges of current age by rank in the model are⁷:

⁶ Appendix D provides model distributions for years of service at retirement.

⁷ Appendix D provides model distributions for current age.

Lieutenant (O-3):	28-34 years old
Lieutenant Commander (O-4):	31-41 years old
Commander (O-5):	37-47 years old

F. YEARS OF SERVICE (YOS)

Years of service involves two variables, years of enlisted service and years of officer service. Both values in the model contain distributions; total years of service is the sum of these two variables. Years of enlisted service is based on the average amount of service time for sailors who ascend to the officer ranks; years of officer service is based on the range of allowable years of service for officers given a specific rank. The range of years includes possible FOS and early promotion periods. The model was developed to ensure that years of service and age are consistent. For example, it is impossible for an officer with no prior enlisted service to have 10 years of service at age 29 (assuming commissioning at age 22). Likewise, an officer who has 5 years prior enlisted service cannot have 10 years of service at age 26 (assuming enlisted at age 18). A constraint was placed within the model to ensure consistency in the maximum years of service, expressed as:

Current Age – 18 $\geq$ YOS for prior enlisted officers, and

Current Age – 22 $\geq$ YOS for officers without enlisted experience.

Years of service is important because it helps determine the life expectancy for officers at retirement.

The distribution for years of enlisted service was calculated using a discrete distribution in which a percentage for each year was provided. The model used percentages based on research conducted by Astrella⁸ (1998). The following years of enlisted service ranges with their associated probabilities are used in the model⁹:

⁸ In his thesis, *An analysis of the Effect of Prior-enlisted Service on Navy Officer Performance* (1998), Astrella provides information concerning the frequency and percentage of his sample of years of prior enlisted service from 0 to 10 years. This information is provided separately for staff officers and line officers. These figures were combined to derive percentages for prior enlisted years for the entire sample to use in the model.

⁹ Appendix D provides model distributions for years of enlisted service.

0 YOS:	71%	3 YOS:	1%
4 YOS:	3.7%	5 YOS:	2.1%
6 YOS:	2.5%	7 YOS:	2.2%
8 YOS:	.9%	9 YOS:	.6%
10 YOS:	1.6%		

The distribution for years of officer service was determined using the average period when officers are promoted to their current rank, and the number of years of service required prior to promoting to the next rank, including possible FOS. The range of YOS previously eligible for early separation was 6-18. For this reason, the minimum years of service for Lieutenants (O-3) is 6, and Lieutenant Commanders' (O-4) and Commanders' (O-5) maximum years of service is 18. The ranges of years of officer service corresponding to rank are provided below¹⁰:

Lieutenant (O-3):	6-12 YOS
Lieutenant Commander (O-4):	9-18 YOS
Commander (O-5):	15-18 YOS

G. LIFE EXPECTANCY

Life expectancy is the projected years retired officers will live. This factor contributes to the present value calculations described in further sections of this chapter. The Department of Defense Actuary table projects the life expectancy of officers for each given age (2003). The life expectancy value in the table is the remaining years officers can expect to live. This table is provided in Appendix D. The model computed the officers' age at retirement, which was used to reference the life expectancy table using the following equation:

$$(\text{YOS at retirement} - \text{current YOS}) + \text{current age} = \text{retirement age}$$

The computed age provides a reference for the life expectancy tables.

¹⁰ Appendix D provides model distributions for years of officer service.

H. DISCOUNT RATE

The model uses the discount rate in the present value calculations described in future sections. As discussed in Chapter IV, the government discount rate used in this model is $10\% \pm 3$. The government discount rate used in this model is a constant that must be provided prior to model simulation or calculations. The model included sensitivity analysis by simulating 7%, 10%, and 13% discount rates.

When determining the personal discount rate, the model uses a range of possible discount rates to simulate individual preferences. The personal discount rate was discussed in Chapter V. This rate provides a basis for present value calculations for the individual's evaluation of early separation incentives. The model uses a normal distribution in the personal discount rate simulation. The mean of the distribution is 16% with a standard deviation of 2%¹¹.

I. COMPUTATIONS WITHIN THE MODEL

1. Annual Retirement Payment

The model uses various combinations of the above variables to analyze the values of possible early separation incentives. The first calculation is annual retired pay. This is the annuity officers will receive for each year of retirement. The computation uses retirement rank, the 2005 basic pay tables, and years of service at retirement to determine the annual retirement payment. The maximum amount of years of service at retirement is 30. The following equation is used to determine annual retirement payments¹²:

$$(\text{Monthly Basic Pay} * (50\% + (\text{RetiredYOS} - 20) * 2.5\%)) * 12$$

The annual retirement payment is the annual stream of money retired officers receive for the remainder of their lives.

2. Maximum Lump Sum Offer

Using annual retired pay, life expectancy and the discount rate, the annual retirement payments were converted into their present value. Once a present value was

¹¹ Appendix D provides the normal distribution information for the personal discount rate.

¹² Monthly Basic Pay is based upon 2005 Pay Tables, using rank at retirement and total years of service at retirement to determine the appropriate amount.

obtained, the model computed the weighted average of the present value for each possible retirement rank. The weighted average multiplies the present value for a specific rank times the probability of promotion to and retirement at that rank. Finally, the maximum incentive the government should offer is computed by adding these weighted averages. Given the original characteristics of an officer, this value reflects the potential costs to the Navy of retiring this officer. In order to save money, the government should offer an incentive for early separation that is lower than this maximum value.

3. Maximum Annuity Offer

A maximum annuity incentive is also determined in the model. This value is determined based upon the maximum lump sum, the government discount rate, and an annuity period that is two times the officer's current years of service. The annuity incentive is consistent with the Navy's incentive policy of the 1990s where annuities were paid for periods of two times the years of service when the officer was separated.

4. Theoretical SSB/VSI Payments Based on Previous Policies

Based upon the characteristics of rank and years of total service, the model computes theoretical SSB and VSI payments. The computations reflect the cost savings the Navy would achieve in a hypothetical simulation. The SSB and VSI payments are computed based on the equations provided in Chapter II.

5. Minimum Incentive for Individuals

A separate simulation provides results for the minimum amount that individuals will accept to separate from active duty early. This calculation is the same as for the maximum offers for the Navy. The difference is the discount rate. The minimum incentive calculation includes a discount rate based upon a normal distribution. Using this discount rate, the individual would require the value of the payment computed in the model as the minimum incentive offer to voluntarily separate early.

6. Cost Savings to the Navy

The final computation in the model is the cost savings to the Navy. The value is determined by taking the difference between the maximum amount the Navy should offer and theoretical amounts that were offered based on the VSI/SSB calculations. Although the model does not compute cost savings by comparing the maximum the Navy should

offer and the minimum an individual will accept, this calculation is included in the analysis of model results in the following chapter.

J. SIMULATION PROCEDURES

A total of 12 simulations were run using the data and calculations described above. All simulations contained 5000 trials. The number of trials provided a sample that is large enough to provide significant analysis concerning the Navy's costs and savings from providing early separation incentives. Appendix I provides the results from each of the simulations.

Simulations were conducted for discount rates of 7%, 10%, and 13% and ranks of O-3, O-4, and O-5. These simulations produced analysis of the maximum incentives the Navy should offer, as well as the corresponding values based upon the prior VSI and SSB policies.

Another set of simulations was conducted to analyze separation incentives from an individual's perspective. For this analysis, simulations were run for ranks of Lieutenant (O-3), Lieutenant Commander (O-4), and Commander (O-5) using the normal distribution for the personal discount rate.

THIS PAGE INTENTIONALLY LEFT BLANK

VII. DATA ANALYSIS AND INTERPRETATION

This chapter analyzes the simulation results, interprets the data by category, and finally offers policy recommendations based upon the data.

As expected, the Navy attains greater cost savings if the government discount rate is lower. Evidence of this is seen in the analysis of cost savings to the Navy in the following sections. Although the model indicates Navy savings in each category, the savings are most drastic when the discount rate is lower (7%) than when it is higher (13%).

Section A of the chapter discusses the results of the simulations for the Navy, theoretical lump sum (SSB) and annuity (VSI) incentives, as well as the minimum acceptable payment for the individual. Section B discusses cost savings to the Navy by comparing the values discussed in the first section. Finally, Section C discusses possible policy considerations resulting from the simulation. All simulation results discussed in this chapter are the values which provide 75% certainty from simulations with 5,000 trials. This certainty was selected because it portrays the payment amounts required to separate 25% of each grade. Detailed statistics and graphs are included in Appendix G.

A. SIMULATION RESULTS

1. Navy's Maximum Recommended Incentive Offer

Navy's Max Lump Sum Offer (Present Value)			
	7%	10%	13%
O-3	\$142,861	\$62,517	\$29,428
O-4	\$250,545	\$124,554	\$66,103
O-5	\$401,795	\$232,102	\$140,549

Table 3. Navy Maximum Recommended Incentive Offer

The model computed the Navy's maximum recommended offer by determining the weighted average of present values for retirement payments for each rank. This computation is the expected cost to the Navy for the individual to retire at each rank. As discussed earlier, the cost to the Navy is higher when a lower discount rate is used. The Navy will not incur these costs until the individual retires, as a result, the retirement cash flows were discounted to reflect current year dollars based on the given discount rates.

The cost to the Navy is greater for more senior ranks (Commander (O-5) vs. Lieutenant (O-3)). This reflects the expectation of promotion to higher ranks prior to retirement. As officers advance to more senior ranks, the probability of achieving the highest rank increases. In the case of the model, the highest rank is Captain (O-6). While it is true that competition increases for each advancement, officers are more likely to achieve this rank when they are one promotion away, as is the case of a Commander (O-5) being promoted to Captain (O-6). Lieutenants (O-3) have a lower probability of reaching Captain (O-6) than Commanders (O-5), because they must advance through three levels of promotion instead of one. While the cost may be greater for Commanders, they are presumably of higher quality than Lieutenants. Commanders have ascended the ranks, completing several competitive promotion levels, and are more proven than Lieutenants. There is a tradeoff between quality and cost that must be considered when evaluating the target population for early separation incentives.

2. Theoretical VSI Offer

Theoretical VSI Offer (Present Value)			
	7%	10%	13%
O-3	\$83,876	\$69,754	\$59,342
O-4	\$199,964	\$157,123	\$127,516
O-5	\$395,359	\$296,134	\$233,513

Table 4. Present Value of Theoretical VSI (Annuity) Offer

The model computed the theoretical VSI offer using the current pay tables and the early separation incentive policies from the 1990s. The computation used the current rank of the officer, current years of service, and the government discount rate to determine the present value of the annuity offered. As the discount rate increases, the present value of the annuity decreases.

3. Theoretical SSB Offer

Theoretical (SSB) Offer	
O-3	\$55,034
O-4	\$105,289
O-5	\$185,215

Table 5. Theoretical SSB (Lump Sum) Offer

The theoretical SSB offer does not depend on the discount rate because it is not a present value calculation and does not reference the discount rate. The model calculated

the SSB offer based on the 1990s drawdown as discussed in Chapter II. Because it is calculated based on the current characteristics of individuals, and is a current lump sum payment, there is limited variation in this calculation. The only variable affecting the SSB calculation is years of service, which, along with rank, determines base pay.

4. Minimum Payment for Individual Acceptance

Minimum Individual Requirement	
O-3	\$15,953
O-4	\$39,015
O-5	\$83,474

Table 6. Individual's Minimum Incentive Payment

As discussed in Chapter V, the individuals' discount rate is a factor in determining how much incentive they require to separate early. Although other factors are discussed, the model only used a distribution of the discount rate to determine the minimum required by individuals. The normal distribution used for the simulation contained a mean of 16% with a standard deviation of 2%. Following the trend of the maximum amount the Navy should offer, the amounts increase as individuals advance in rank. As individuals increase in rank, they have a better chance of making higher ranks and they also believe that they have a better chance. Similar to the cost of retirement incurred by the Navy, the minimum incentive payment was discounted to current dollars using the range of discount rates from the Monte Carlo simulation.

B. COMPARISON OF RESULTS

1. Navy Savings Compared to Theoretical VSI Offer

Potential Savings to the Navy Maximum Offer vs. Theoretical VSI			
	7%	10%	13%
O-3	\$58,985	(\$7,237)	(\$29,914)
O-4	\$50,581	(\$32,569)	(\$61,413)
O-5	\$6,436	(\$64,032)	(\$92,964)

Table 7. Potential Savings to the Navy Based on Theoretical VSI Offers

The numbers in the table were computed by subtracting the theoretical VSI payment (25%) from the maximum payment the Navy should offer to separate 25% of the force.

When comparing the maximum amount the Navy should offer to achieve a 25% separation rate to the theoretical VSI offer required of the cheapest 25%, the maximum offer is greater only when using the 7% discount rate. If the Navy values the incentives based upon a 10% or 13% discount rate the theoretical VSI payment is greater than the maximum that the Navy should be willing to offer. In this case it appears that the Navy is offering too much money as an incentive for officers to separate early. One can infer from these results that there were factors (other than purely financial) considered by the Navy in determining its early separation offers.

2. Navy Savings Compared to Theoretical SSB Offer

Potential Savings to the Navy Maximum Offer vs. Theoretical SSB			
	7%	10%	13%
O-3	\$87,827	\$7,483	(\$25,606)
O-4	\$94,675	\$19,265	(\$39,186)
O-5	\$216,580	\$110,919	(\$44,666)

Table 8. Potential Savings to the Navy Based on Theoretical SSB Offers

The values for Table 8 were computed by subtracting the theoretical SSB payment (25%) from the maximum amount the Navy should be willing to offer as an early separation incentive to ensure a 25% separation rate.

If individuals select a Lump Sum payment as an early separation incentive, the difference between the Navy's maximum offer and the theoretical SSB payment is larger than the VSI option based upon the theoretical values computed in the model. Although there appears to be greater long term savings, the Navy would have to pay more initially for the SSB option than the VSI option. As seen in the VSI comparison, the Navy saves more when using a lower discount rate than a higher discount rate. As seen in the table, if the Navy uses a 13% discount rate it will actually pay individuals more to separate than the maximum amount it should offer. In the long, run using the 13% discount rate, the Navy actually loses money instead of saving.

3. Navy Savings Compared to Individual Minimum Acceptance Amount

	Difference between Navy and Individual		
	7%	10%	13%
O-3	\$126,908	\$46,564	\$13,475
O-4	\$211,530	\$85,539	\$27,088
O-5	\$318,321	\$148,628	\$57,075

Table 9. Comparison of Navy's Maximum Offer Amount and Individual's Minimum Acceptance Amount

If the Navy offered the minimum incentive that individuals would accept, it would reduce the costs of retiring active duty officers. The greatest savings come from a Commander (O-5) using a 7% government discount rate. The Navy would save more for higher ranks if it utilized this policy. The comparison between the individual and the Navy indicates that there is room for a compromise between the two values. This would allow the Navy to obtain cost savings, but would also provide some extra benefit to individuals. If the Navy offered an incentive between its maximum value and the individual's minimum it would reach its goals of drawing down the force and at the same time saving money. As the Navy increases its incentive, it will pay extra benefits to those that would have accepted lower amounts. The Navy should set a policy that reduces the force to acceptable levels and reduces excess payments.

Lieutenants (O-3) would be willing to accept an offer that is approximately 11% of the maximum amount the Navy is willing to provide at a 7% discount rate, while Commanders (O-5) would require at least 20% of the Navy's maximum offer. At a 13% discount rate, Lieutenants (O-3) must receive approximately 54% of the maximum amount the Navy is willing to offer and Commanders (O-5) must receive approximately 60%. These percentages indicate an increase in individuals' expectations to retire. The more senior individuals are the higher their expectation of retirement, and the more they will require for separation prior to retirement. As the discount rate increases from 7% to 13%, it approaches the personal discount rate. As a result of this individuals' requirements are closer to the Navy's recommended maximum and the percentages are greater.

4. Theoretical VSI/SSB Compared to Individual Minimum Acceptance Amount

Theoretical VSI - Individual Minimum			
	7%	10%	13%
O-3	\$67,923	\$53,801	\$13,475
O-4	\$160,949	\$118,108	\$27,088
O-5	\$311,885	\$212,660	\$57,075

Table 10. Comparison of Theoretical VSI and Individual Minimum Acceptance Amount

Theoretical SSB - Individual Minimum	
O-3	\$39,081
O-4	\$66,274
O-5	\$101,741

Table 11. Comparison of Theoretical SSB and Individuals Minimum Acceptance Amount

A comparison of the theoretical VSI/SSB payments and the individual's minimum requirement demonstrates that the Navy would be offering an option that is higher than the individual is willing to accept. Assuming the conditions are similar to the 1990s, it appears that individuals were accepting an amount that was significantly greater than what they required for acceptance. For Lieutenants (O-3), the SSB offer is approximately \$39,081 greater than the minimum amount an individual would be willing to accept based on the model. For Commanders (O-5), the SSB offer is about \$101,741 greater than the minimum requirement. In the case of the VSI incentive for Lieutenants (O-3), the offer is approximately four times \$67,923 greater than the minimum amount using a 7% discount rate, and approximately \$13,745 greater using the 13% discount rate. Commanders (O-5) would receive an incentive that is much larger than their minimum amount based on these theoretical values as well. As discussed in Chapter V, there are many reasons other than financial incentives for individuals to accept an early separation offer. Similarly, there may be reasons for the Navy to provide incentives that are much greater than the minimum the individual is willing to accept.

C. POLICY CONSIDERATIONS

Economic rents occur when individuals are compensated more than they require when accepting the early separation incentive. There is a large difference between the

Navy's maximum offer and the individual's minimum acceptance amount. If the Navy pays its maximum it would be providing large economic rents to all individuals. In order to prevent this from occurring, the Navy should attempt to determine the minimum required amount. By gaining knowledge about the individual and understanding its own costs, the Navy can reduce the amount of economic rent it pays when offering an early separation incentive.

If the Navy sets a drawdown policy and specifies a set payment it will offer, it will most likely compensate individuals to leave the service when they would have separated without the benefit or for a significantly lower payment. This will occur even if it reduces the rent as discussed above, and does not offer its maximum amount. Illustrations of economic rents can be observed by comparing the percentiles for the minimum amount required by individuals and the Navy's maximum incentive offer in Appendix G, as well as the cumulative graphs for the same variables. An example of economic rents is observed for Lieutenants (O-3) and a 7% discount rate. Based on these parameters the Navy would have to offer at least \$142,851 to ensure that 25% of the Lieutenants (O-3) accepted the offer. This amount will ensure that the individual in the 25th percentile will accept the offer. All individuals other than the last one, however, will require a smaller amount than \$142,851. This includes a large majority of Lieutenants (O-3) who would have separated without the incentive. For individuals not requiring an incentive to separate, the Navy is paying an economic rent of \$142,851.

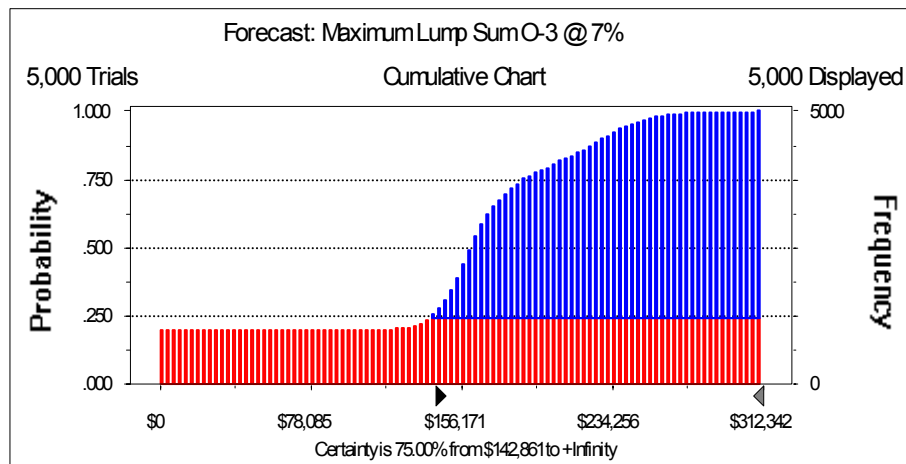


Figure 2. Maximum amount Navy is Required to Pay to Ensure 25% of Lieutenants Separate

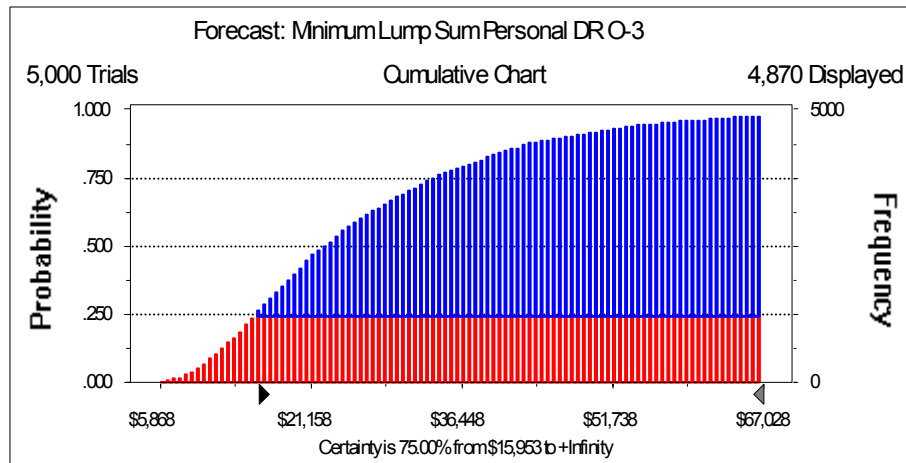


Figure 3. Minimum Amount Required by 25% of Individuals to Separate Early

If the Navy targets the officers with the lowest quality, they have the least likelihood of advancing in rank, and result in the lowest cost savings to the Navy. On the other hand, the personnel who will provide the most cost savings are officers who have the highest likelihood to retire after advancing to Captain (O-6). These officers are presumably the highest quality officers from the target population, and the Navy would prefer retaining them on active duty. The Navy must achieve a balance in which it is able to save money and also able to separate the officers that provide the lowest utility to the service. Policies may also be constructed with one of the two specific aims: separating the lowest quality officers without a focus on cost savings, or achieving the highest cost savings regardless of the quality of officers that are separated as a result of the policy. In the first case, the Navy would provide relatively low incentives. This would target those officers that have the lowest possibility of advancement. As discussed in Chapter V, one assumption that must be made for this policy is that officers understand their standing relating to future promotions, the higher quality officers will then not choose to accept the incentive because they believe that they can obtain greater benefits from remaining on active duty. In the second option, the Navy would offer a larger sum of money with the intent of enticing officers who would promote to higher levels and would cost the Navy more as a result. As discussed previously, this would cause economic rents because officers willing to accept a much smaller sum of money would take this offer as well as the officers that are targeted for the cost savings. Another issue with this focus is that the

Navy may entice more officers to separate than it had planned possibly leading to manpower deficiencies.

One of the possible ways to eliminate the economic rent as well as the quality and quantity issue is a sealed bid auction. With this method of allocating incentives, the Navy offers an incentive but requires individuals to determine the minimum amount of money they would require to separate early. Based on dollar and quantity thresholds set by the Navy, it would determine if the individual should be compensated for separation. The process would start with the lowest bidder and continue to provide early separations until the desired drawdown goal is met. Assuming that individuals are not inflating their bids but are giving a realistic value, this process should eliminate economic rents. Individuals would honestly convey the value of an early separation and would not receive more compensation than they desire. The process would also achieve the quality goal. Individuals who believe that they will advance in rank will likely provide a higher bid. By accepting lowest bids first, the Navy would separate the lower quality officers and retain higher quality officers.

In order to provide the incentive that will optimize the quantity and quality of officers separated, the Navy must understand the current conditions and points of view of individuals. If there is information for individuals to make educated judgments about their future and promotion possibilities, the Navy will likely separate lower quality officers. Considerations must also be made for the current economic conditions and potential for civilian earnings. By understanding these factors, the Navy could approximate the personal discount rate and provide an incentive that will meet its drawdown needs, maximizing quality and cost savings.

THIS PAGE INTENTIONALLY LEFT BLANK

VIII. OTHER CONSIDERATIONS

A. OTHER RETIREMENT COSTS

1. Medical Benefits

The Navy continues to provide medical benefits after individuals retire. Medical insurance is beneficial to retirees, but very costly for the Navy. There are very few payments that retirees and their family members have to make when they receive medical treatment.

Medical costs were not included in the model, but they are important factors in determining the total cost to the Navy for retired personnel. If the cost of retiring personnel included medical benefits, the maximum amount the Navy would be willing to offer for an early separation incentive would increase. It is not clear how individuals value their medical benefits. As a result, it is difficult without further research to identify the actual cost savings to the Navy from early separations.

While the actual medical treatment costs for retirees comprise a majority of the Navy's cost there are other associated costs. Health care administration poses a significant cost to the Navy. Administrative costs include processing patients' claims as well as finding adequate care when sufficient care is not provided by Department of Defense facilities. There is also a cost in manpower to treat retirees. In areas where military facilities are available, additional active duty personnel are required to provide care to retirees in addition to active duty personnel. CBO estimated that health care accrual per active duty member in the Department of Defense was \$5000 for retirees not eligible for Medicare, \$6000 for Medicare-eligible retirees, and \$11,000 for veteran's health benefits in 2002 (2003).

2. Other Benefits

Retirees are also eligible for other benefits, which increase the Navy's retirement cost. These benefits include base privileges offered to active duty personnel. Some of these benefits include recreation facilities, lodging facilities, commissaries, and exchanges. It is beyond the scope of this research to determine the actual costs to the Navy for each of these services and the corresponding cost for each individual retiree.

Although it is not included in this research, these costs should be analyzed to provide the total costs to the Navy for retirees. Other retirement benefits add to the Navy's total cost of retirement and the savings that could be attained by separating active duty personnel early.

B. ACTIVE DUTY COSTS

This analysis assumes that officers considering separating early provide the Navy some benefit. If they separate, the Navy must pay for the service they provided in some way, such as contracting out. Using this assumption, the Navy would not save all of the active duty entitlements if they separated early.

The other likely possibility is that the officer is no longer needed and the Navy would not fill the vacated position. This situation could result from increased efficiencies eliminating the tasks that the officer performed. Currently the Chief of Naval Operations is emphasizing the use of technological advances to make the force more efficient and reduce manpower requirements. Based upon this guidance, the cost to maintain officers on active duty is another relevant factor in determining the proper incentive to offer. In this case, analysts must consider officers' pay and allowances when computing savings to the Navy from early separations. There are also occasions when specific skills are no longer required, and not transferable to another position. These cases provide an opportunity for the Navy to offer early separation incentives instead of spending time to train personnel for another function.

Assuming that neither these officers nor their positions are needed would increase the maximum amount the Navy would be willing to pay for early separations and likely increase the savings resulting from these programs. Appendix H provides calculations and comparisons for officers with average characteristics from the model to illustrate the increased savings to the Navy from downsizing personnel in billets that no longer provide a benefit. This appendix also discusses active duty costs and the method for applying them to the calculations.

IX. CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY

1. Discount Rate

There are several conclusions from the research and the model simulations. The first conclusion is that the discount rate is central to analyzing future cash flows. As seen in the comparison of the data output from the model, the lower the discount rate, the greater the savings for the Navy. One reason is that the higher discount rate provides a closer approximation to the high personal discount rate.

There are a wide variety of discount rate options available for future value calculations. It is important to remain fairly consistent by using the same discount rates for analyses. If the same discount rate is not used, this could skew the data and artificially make a project look better (or worse) than it really is. Analysts must remain consistent and ensure that they are not changing the discount rate to change the outlook of a project.

While it has been difficult to reach a consensus regarding the discount rate, there are several principles present throughout the variety of approaches. Opportunity cost is the central issue of a discount rate. Opportunity cost attempts to capture the project or action that is forgone as a result of the current project. Analysts disagree about whether the opportunity lost involves consumption or investment. For this reason, many advocate using a government discount rate that considers both investment and consumption opportunity costs. Risk and uncertainty are two other factors in choosing a discount rate. Although it is unclear exactly how to capture risk, analysts agree that it should play a significant role in decision making. The final issue is whether discount rates should reflect a portfolio of projects or a marginal project. Currently there are no exact answers to these questions. The important point is that individuals should attempt to be consistent in their application of the discount rate to avoid biasing the analysis.

2. Personal Decisions

When the Navy is creating policies to shape the force, it must consider personal preferences. If this does not occur, it is likely the Navy will not meet its goals of quality

and quantity. Individuals tend to have a higher discount rate when making financial decisions including the early separation incentive. Evidence of this is seen in the behavior of individuals during the 1990s. Based on the research it is also clear that each individual is unique. As a result, methods for decision making as well as the rationale behind decisions are not the same among individuals. The Navy should be sensitive to the methods of personal decision making for individuals it is targeting to separate early. By understanding how individuals think and make decisions, the Navy will be able to create a more strategic incentive program, providing a benefit to those accepting the offer as well as cost savings to the Navy.

3. Evaluation of Data

Results of the simulations show that the Navy will save money by implementing early separation incentives. The total amount of savings is unclear. In most cases there is a substantial gap between the maximum the Navy is willing to offer and the minimum individuals require. If an incentive amount falls between these two values, the Navy will benefit from savings, and individuals will also benefit from a larger incentive than they required. The essential part of incentive offers is that the amount must be large enough to entice the desired quantity of separations but not encourage more individuals to separate than planned. The other result for the Navy to consider is quality. The goal is to separate a majority of lower performing individuals. This is only accomplished by carefully implementing and monitoring the incentive system and understanding current conditions affecting decision making.

As discussed in the personal decision section, individuals do not always behave the way economic theory says that they should, nor does the Navy. This is the case for some parts of the simulation when the VSI/SSB offer is greater than the maximum amount the Navy should offer. These calculations were based on the previous policies. Based on the simulation it appears that some individuals were offered incentives that were above their minimum, and the Navy's maximum offer. This result indicates that the decision regarding incentive amounts is more complicated than strictly a financial decision. There are other outside factors which encourage the Navy to offer incentives greater than their maximum offer. While the Navy cannot fully capture all of the personal factors, it must understand what they are and how they affect individual decisions to

construct an effective policy in the future. It must understand the factors leading to its decision to ensure that it is offering incentives which provide the maximum benefit in terms of quality and cost savings.

B. RECOMMENDATIONS

After reviewing the history of the separation incentive program, it is clear that the Navy could produce a better offer that would optimize its savings as well as achieve the desired quality and quantity of separations. In order to accomplish this most efficiently, it should target more specific groups of officers. By reducing the number of possibilities, the Navy would be able to structure an incentive that would benefit a specific group but would not apply to the overall Navy. By using the model and possibly expanding it, the Navy will be able to predict the amount that individuals require to accept the separation. If it narrows the available target for a given incentive, it should be able to eliminate the proper quantity of officers, maintain the level of quality and maximize cost savings.

One way the Navy could use the incentives is to include age considerations for physically demanding jobs. These jobs include aviators or special warfare personnel. As these officers increase in age they are not as able to perform their duties as well as they had when they were younger. Although these officers are still able to remain on active duty, they are not fully capable of performing the tasks they joined the Navy to perform. Providing early incentives to these types of officers would allow the Navy to separate those officers no longer able to maintain the highest standards of performance physically, and would also provide the officers with some benefit for their honorable service in the Navy. This would provide more opportunities for younger, more capable officers, while maintaining morale, increasing quality, and providing cost savings to the Navy.

Other methods of implementing a separation incentive may produce better results and reduce some of the wasted contributions the Navy made in the 1990s. Wasted contributions refer to the amount of economic rents paid to individuals. If the Navy created a system in which individuals were part of the process to determine the incentive, the Navy would reduce the economic rents it pays. One of these methods is the sealed bid auction. This method would work like an “eBay model” for separation incentives.

The government would set a maximum ceiling that it is willing to offer. This ceiling could be unknown to the bidders. Personnel would provide the amount they are willing to receive to separate. The Navy would choose selections starting with the lowest bid and continuing until the reduction goal is met. By selecting this method for administering the bonus, the Navy allows economic principles to guide the decision regarding the amount of bonus it should offer. The success of this method requires that individuals understand the process and make a fair and honest valuation of the amount they are willing to accept. If this is the case, individuals will receive the amount they require to separate and the Navy will reduce the economic rents it pays to individuals to separate prior to retirement.

C. FURTHER RESEARCH

One area for future research involves developing a model that incorporates active duty costs with retirement costs to produce the costs and savings for the Navy to implement its separation programs.

More research also needs to be conducted regarding the cost to the Navy for providing medical benefits and other non-cash benefits to individuals. This would most likely demonstrate that the Navy's savings are much larger when these cost considerations are accurately taken into account.

Another question that surfaced during research for this thesis was the amount of knowledge individuals possess regarding their decision. Analysis into knowledge could determine how much individuals think that they know regarding their current standing, future in the Navy, and future civilian options. The more knowledge individuals have about their future, the less risky decisions become. Part of this analysis would not only identify the knowledge base, but would also identify methods the Navy could employ to provide more information and educate more individuals in the future.

This research did not factor compensation increases in the model. Further research could take the basic model created in this thesis and incorporate pay and benefit raises. Although this analysis made the assumption that increases are in line with inflation in the long run, the definition of long run is not clear. To determine the costs and savings in the next few years, it would be important to identify increases in

compensation. Based on the Navy's 2005 budget submission, each form of compensation is unique and increases to each item are different. By factoring in increases in compensation programs, the model and its forecasts would be more accurate.

Finally, this research included a large and varying group of individuals in terms of skills and functions in the Navy. Conversely, it was specific to three current ranks. Further study could look at other categories within the Navy to reach force shaping goals and maintain quality. One possible group could be those individuals who have been in the service for at least 20 years. These officers have already reached retirement eligibility and would not provide cost savings to the Navy in that respect. The target of this incentive is the group that knows they can retire but remain on active duty to accumulate additional years of service and larger retirement benefits. Although it is not the case with all such service members, some of these officers are not high performers and are not as motivated as some of their younger peers. Providing an incentive to these individuals would reduce manpower levels, improve the quality of the force, and provide opportunities for motivated junior officers to promote to higher levels. A study could identify the type of incentive to offer individuals who already know they are going to retire. Offering the proper incentive may persuade individuals to retire before they otherwise would have.

D. CONCLUSION

If applied properly, separation incentives can provide large savings to the Navy. These savings come from both active duty cost savings as well as retirement cost savings. Some of the issues that should be considered when evaluating the proper incentive offer mechanism are the government discount rate, the personal discount rate, private sector economic conditions, the quality of individuals in the target group, promotion probabilities, and individual knowledge about the future. While they are complex issues, understanding the most efficient methods will help the Navy reach its manpower goals in the future, maximizing quality and achieving cost savings. Finally, while the focus of this study was on the officer population in the Navy, this model and its conclusions could also be used to analyze early separation incentives for other services or groups of personnel within the Department of Defense.

APPENDIX A - TERA RETIRED PAYMENT CONVERSIONS

Length of service		
Years	Months	% of basic pay
15	0	35.625
15	1	35.854
15	2	36.084
15	3	36.314
15	4	36.544
15	5	36.775
15	6	37.006
15	7	37.238
15	8	37.469
15	9	37.702
15	10	37.934
15	11	38.167
16	0	38.4
16	1	38.634
16	2	38.867
16	3	39.102
16	4	39.336
16	5	39.571
16	6	39.806
16	7	40.042
16	8	40.278
16	9	40.514
16	10	40.751
16	11	40.988
17	0	41.225
17	1	41.463
17	2	41.701
17	3	41.939
17	4	42.178
17	5	42.417
17	6	42.656
17	7	42.896
17	8	43.136
17	9	43.377
17	10	43.617
17	11	43.859

Length of service		
Years	Months	% of basic pay
18	0	44.1
18	1	44.342
18	2	44.584
18	3	44.827
18	4	45.069
18	5	45.313
18	6	45.556
18	7	45.8
18	8	46.044
18	9	46.289
18	10	46.534
18	11	46.779
19	0	47.025
19	1	47.271
19	2	47.517
19	3	47.764
19	4	48.011
19	5	48.259
19	6	48.506
19	7	48.754
19	8	49.003
19	9	49.252
19	10	49.501
19	11	49.75

Source: http://www.dmdc.osd.mil/tera/owa/ShowPage?p=payoff&p_SID=VQPUOSGXWIS

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX B – 2005 OFFICER MONTHLY PAY TABLES

2005 PAY TABLES

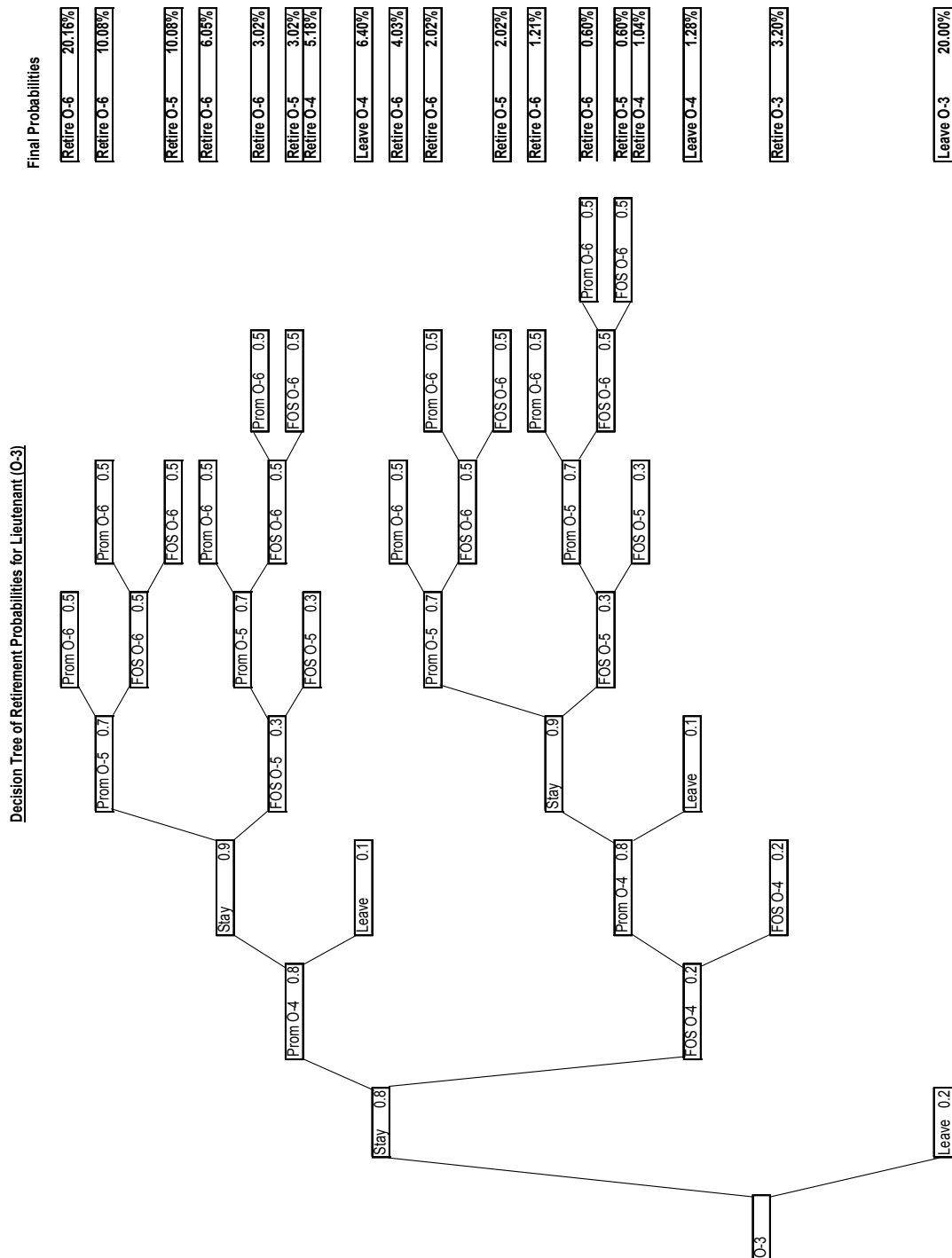
Years of Service

Rank	2-or-less	Over-2	Over-3	Over-4	Over-6	Over-8	Over-10	Over-12	Over-14	Over-16	Over-18	Over-20	Over-22	Over-24	Over-26
O-10												12963.06	13026.72	13297.47	13769.43
O-9												11337.91	11501.23	11737.21	12149.24
O-8	8022.39	8285.07	8459.26	8508.32	8725.36	9089.27	9173.72	9519.00	9618.05	9915.20	10345.55	10742.37	11007.54	11007.54	11007.54
O-7	6666.12	6975.69	7119.14	7233.10	7438.96	7642.65	7878.32	8113.37	8349.03	9089.27	9714.61	9714.61	9714.61	9714.61	9763.67
O-6	4940.68	5427.85	5783.99	5783.99	5806.04	6054.75	6087.97	6087.97	6433.87	7045.56	7404.49	7763.43	7967.74	8174.22	8575.39
O-5	4118.78	4639.80	4961.17	5021.41	5221.37	5341.84	5605.46	5798.90	6048.54	6431.08	6613.34	6793.12	6997.43	6997.43	6997.43
O-4	3553.67	4113.81	4388.30	4449.47	4704.39	4977.63	5317.62	5582.79	5766.61	5872.18	5933.66	5933.66	5933.66	5933.66	5933.66
O-3	3124.56	3542.18	3823.19	4168.15	4367.80	4586.71	4728.60	4962.10	5083.20	5083.20	5083.20	5083.20	5083.20	5083.20	5083.20
O-2	2699.49	3074.57	3541.25	3660.80	3736.25	3736.25	3736.25	3736.25	3736.25	3736.25	3736.25	3736.25	3736.25	3736.25	3736.25
O-1	2343.65	2438.98	2948.20	2948.20	2948.20	2948.20	2948.20	2948.20	2948.20	2948.20	2948.20	2948.20	2948.20	2948.20	2948.20

Source: Maze (2004) Pay Dirt, Navy Times, October 18, 2004

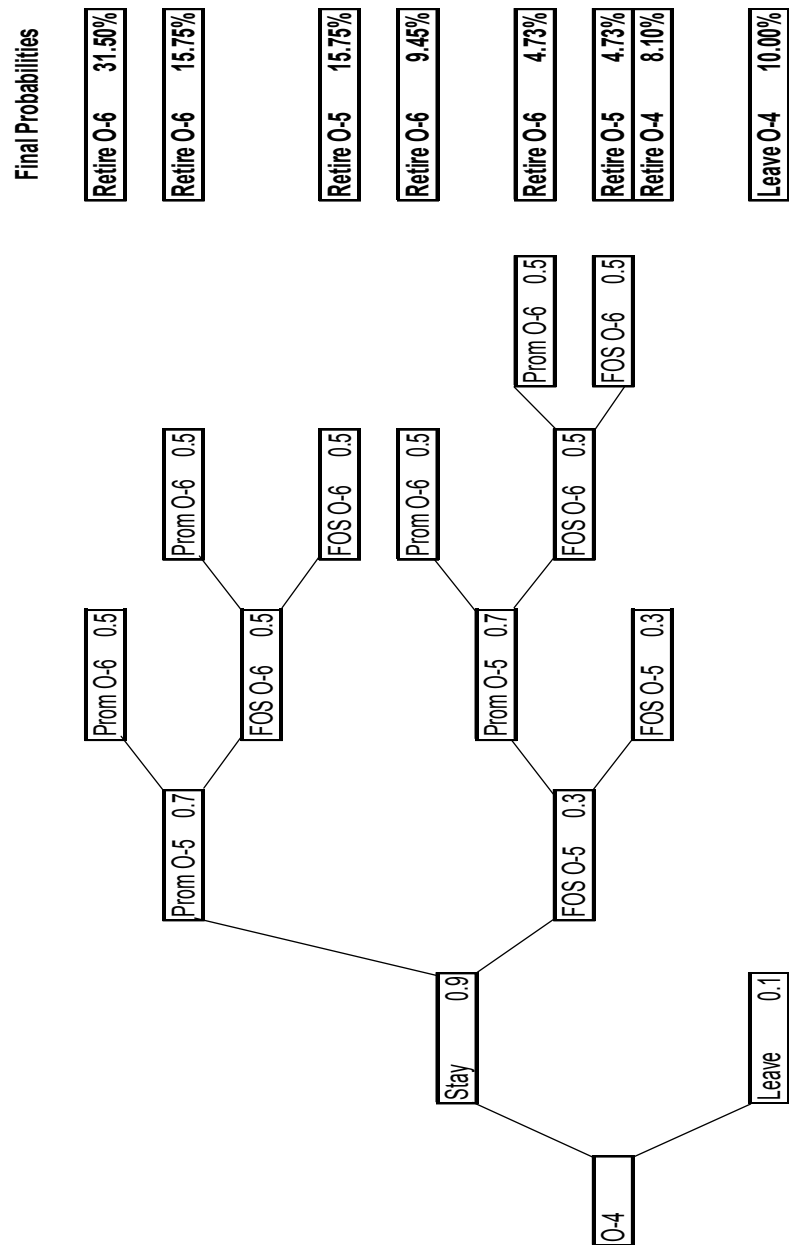
THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX C - PROMOTION AND RETENTION DECISION TREES



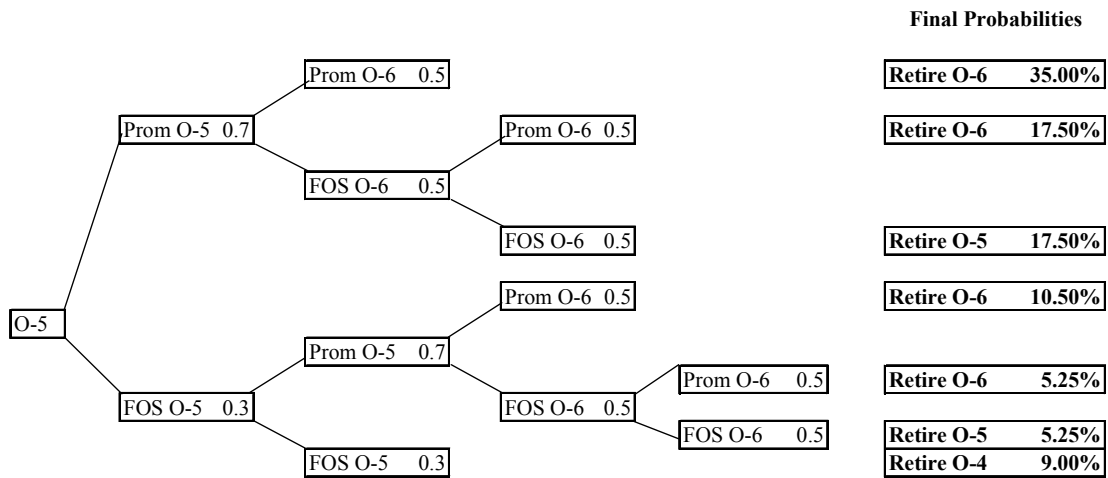
Decision Tree is based upon mean values of promotion probability distributions

Decision Tree of Retirement Probabilities for Lieutenant Commander (O-4)



Decision Tree is based upon mean values of promotion probability distributions

Decision Tree of Retirement Probabilities for Commander (O-5)



Decision Tree is based upon mean values of promotion probability distributions

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX D - MODEL DISTRIBUTIONS

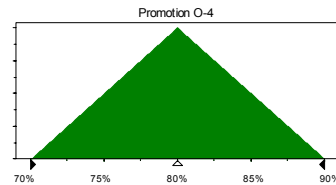
The following appendix provides the distributions for all assumptions that used Crystal Ball to reflect distributions in the model. The source for promotion probability, years of officer service, and years of service at retirement is All Hands website (All Hands, 1997). The source for years of enlisted service is the research conducted by Astrella (1998).

Assumption: (Promotion O-4) - Promotion Probability to O-4

Triangular distribution with parameters:

Minimum	70%
Likeliest	80%
Maximum	90%

Selected range is from 70% to 90%

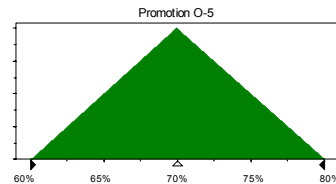


Assumption: (Promotion O-5) - Promotion Probability to O-5

Triangular distribution with parameters:

Minimum	60%
Likeliest	70%
Maximum	80%

Selected range is from 60% to 80%

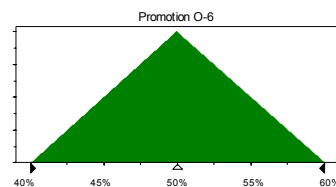


Assumption: (Promotion O-6) - Promotion Probability to O-6

Triangular distribution with parameters:

Minimum	40%
Likeliest	50%
Maximum	60%

Selected range is from 40% to 60%



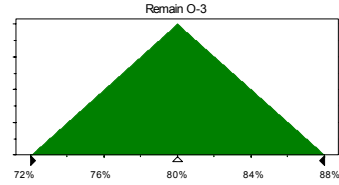
Source: www.chinfo.navy.mil/navpalib/allhands/ah0897/aug-pg89.html

Assumption: (Remain O-3) - Probability of Retention for O-3

Triangular distribution with parameters:

Minimum	72%
Likeliest	80%
Maximum	88%

Selected range is from 72% to 88%

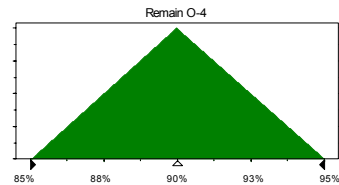


Assumption: (Remain O-4) - Probability of Retention for O-4

Triangular distribution with parameters:

Minimum	85%
Likeliest	90%
Maximum	95%

Selected range is from 85% to 95%

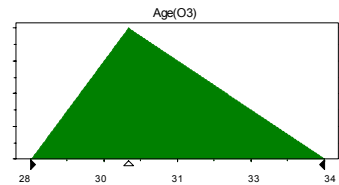


Assumption: (Age(O3)) - Age Distribution for O-3

Triangular distribution with parameters:

Minimum	28
Likeliest	30
Maximum	34

Selected range is from 28 to 34

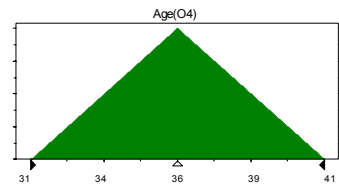


Assumption: (Age(O4)) - Age Distribution for O-4

Triangular distribution with parameters:

Minimum	31
Likeliest	36
Maximum	41

Selected range is from 31 to 41

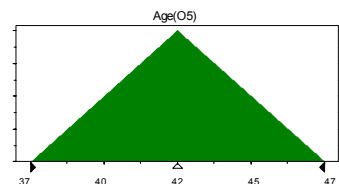


Assumption: (Age(O5)) - Age Distribution for O-5

Triangular distribution with parameters:

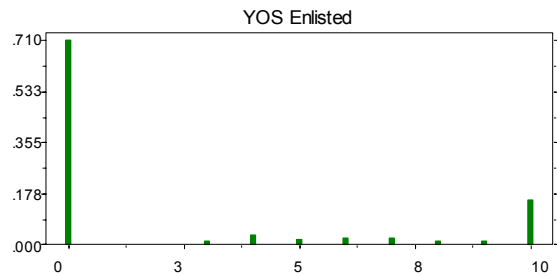
Minimum	37
Likeliest	42
Maximum	47

Selected range is from 37 to 47



Assumption: (YOS Enlisted) - Distribution for Years of Prior Enlisted Service

Custom distribution with parameters:		<u>Relative Prob.</u>
Single point	0	0.710000
Single point	3	0.010000
Single point	4	0.037000
Single point	5	0.021000
Single point	6	0.025000
Single point	7	0.022000
Single point	8	0.009000
Single point	9	0.006000
Single point	10	0.158000
Total Relative Probability		0.998000



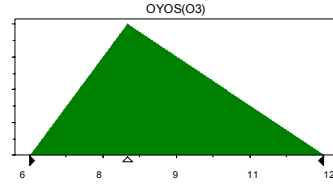
Source: Astrella, M.G. *An Analysis of the Effect of Prior-Enlisted Service On Navy Officer Performance*

Assumption: (OYOS(O3)) - Distribution of Years of Officer Service O-3

Triangular distribution with parameters:

Minimum	6
Likeliest	8
Maximum	12

Selected range is from 6 to 12

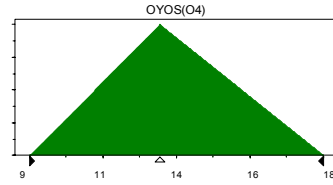


Assumption: (OYOS(O4)) - Distribution of Years of Officer Service O-4

Triangular distribution with parameters:

Minimum	9
Likeliest	13
Maximum	18

Selected range is from 9 to 18

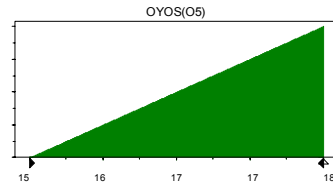


Assumption: (OYOS(O5)) - Distribution of Years of Officer Service O-5

Triangular distribution with parameters:

Minimum	15
Likeliest	18
Maximum	18

Selected range is from 15 to 18



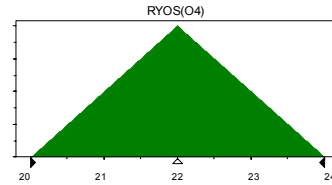
Source: www.chinfo.navy.mil/navpalib/allhands/ah0897/aug-pg89.html

Assumption: (RYOS(O4)) - Distribution of Years of Service at Retirement for O-4

Triangular distribution with parameters:

Minimum	20
Likeliest	22
Maximum	24

Selected range is from 20 to 24

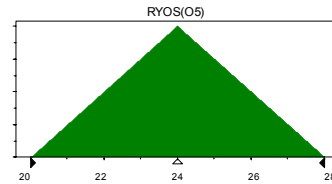


Assumption: (RYOS(O5)) - Distribution of Years of Service at Retirement for O-5

Triangular distribution with parameters:

Minimum	20
Likeliest	24
Maximum	28

Selected range is from 20 to 28

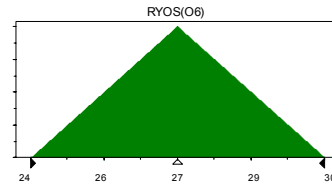


Assumption: (RYOS(O6)) - Distribution of Years of Service at Retirement for O-6

Triangular distribution with parameters:

Minimum	24
Likeliest	27
Maximum	30

Selected range is from 24 to 30



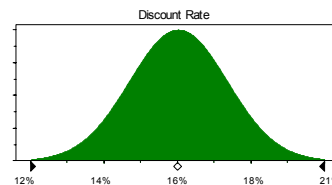
Source: www.chinfo.navy.mil/navpalib/allhands/ah0897/aug-pg89.html

Assumption: (Discount Rate) - Normal Distribution of Personal Discount Rate

Normal distribution with parameters:

Mean	16%
Standard Dev.	2%

Selected range is from -Infinity to +Infinity



THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX E - LIFE EXPECTANCY TABLE

Age (nearest birthday)	Officers
38	46.19
39	45.15
40	44.11
41	43.07
42	42.02
43	40.98
44	39.94
45	38.90
46	37.86
47	36.82
48	35.78
49	34.74
50	33.70
51	32.65
52	31.62
53	30.58
54	29.55
55	28.53

Source: DoD Actuary (2004), <http://www.dod.mil/actuary/statbook03.pdf> p. 270

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX F –MODEL SAMPLE

EARLY SEPARATION OPTIONS					
MODEL RESULTS		ORIGINAL POLICY RESULTS		NAVY SAVINGS	
Expected Lump Sum	\$802,664	SSB Calculated	\$214,272	Lump Sum	\$588,392
Expected Annuity	\$61,577	VSI PMT	\$35,712	Annuity	\$457,096
		PV	\$345,568		
INPUTS		ASSUMPTIONS			
Rank	O-5	Discount Rate	7%	Age(O3)	30
Age	42	Promotion O-4	82%	Age(O4)	34
YOS Enlisted	0	Promotion O-5	70%	Age(O5)	42
YOS Total	18	Promotion O-6	48%	OYOS(O3)	8
		Remain O-3	81%	OYOS(O4)	10
		Remain O-4	90%	OYOS(O5)	18
		RYOS(O3)	20	Life Expect(O-3)	40.98
		RYOS(O4)	23	Life Expect(O-4)	37.86
		RYOS(O5)	24	Life Expect(O-5)	36.82
		RYOS(O6)	26	Life Expect(O-6)	34.74
BACKGROUND COMPUTATIONS					
	Ann Ret Pay	Retirement PV	Probability	Weight Avg	
O-3	\$30,499	\$408,473	0.00%	\$0	
O-4	\$39,162	\$516,278	0.00%	\$0	
O-5	\$48,282	\$632,628	26.65%	\$168,623	
O-6	\$66,888	\$864,456	73.35%	\$634,041	

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX G – SIMULATION RESULTS

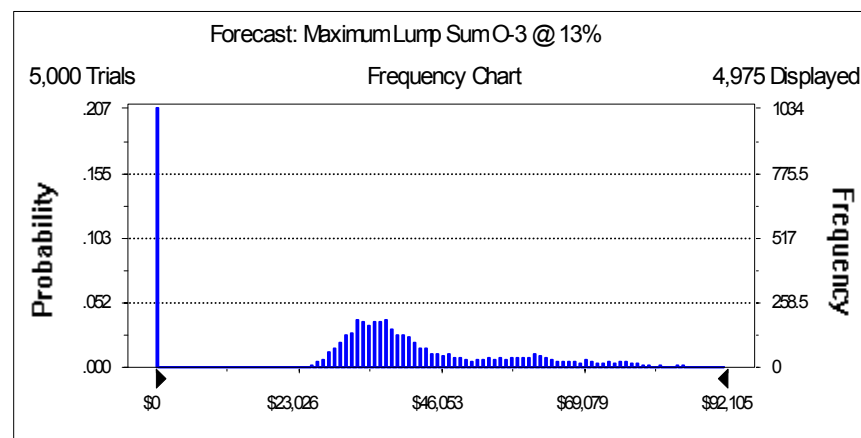
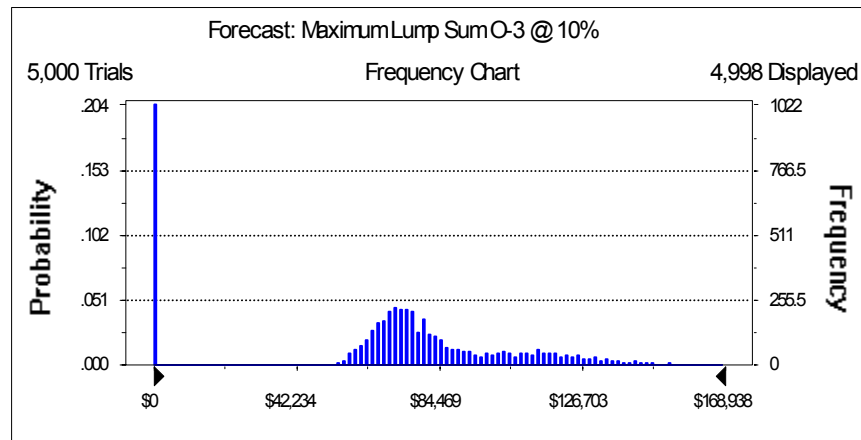
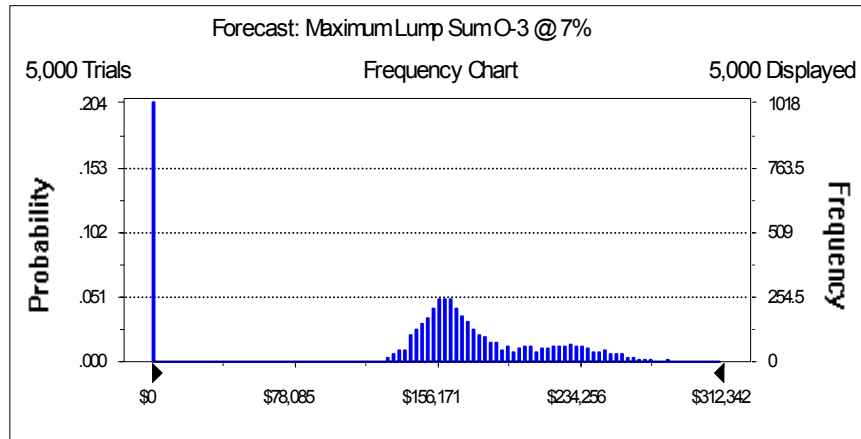
A. MAXIMUM LUMP SUM OFFER BY NAVY

1. Lieutenant (O-3)

Statistics: Maximum Lump Sum Offer by Navy - O-3			
Discount Rate	7%	10%	13%
Trials	5,000	5,000	5,000
Mean	\$144,957	\$68,876	\$35,612
Median	\$162,782	\$74,342	\$36,520
Mode	\$0	\$0	\$0
Standard Deviation	\$79,518	\$40,121	\$22,463
Variance	\$6,323,172,046	\$1,609,701,100	\$504,596,706
Skewness	-0.88	-0.5	-0.07
Kurtosis	2.68	2.61	2.7
Coeff. of Variability	0.55	0.58	0.63
Range Minimum	\$0	\$0	\$0
Range Maximum	\$312,342	\$172,925	\$110,728
Range Width	\$312,342	\$172,925	\$110,728
Mean Std. Error	\$1,124.56	\$567.40	\$317.68

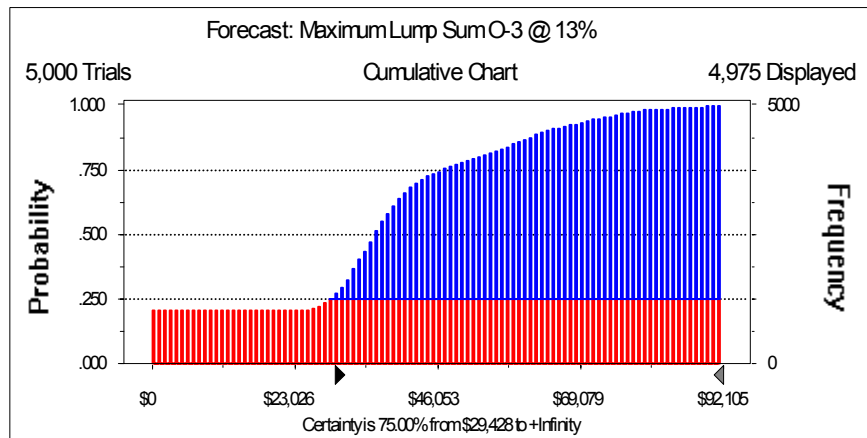
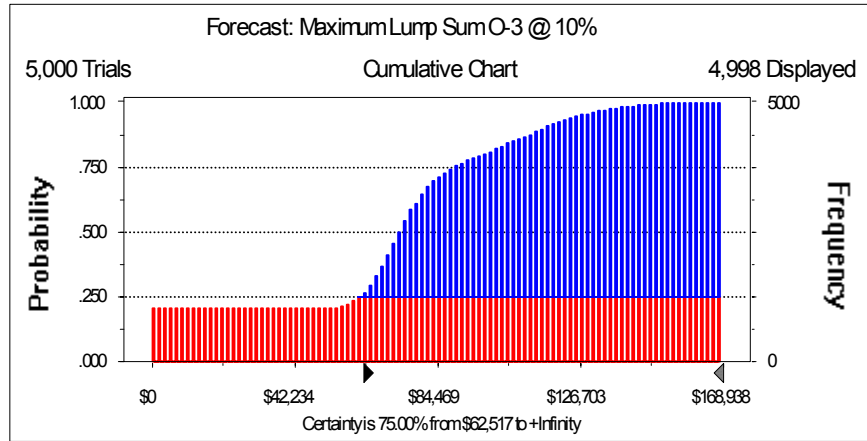
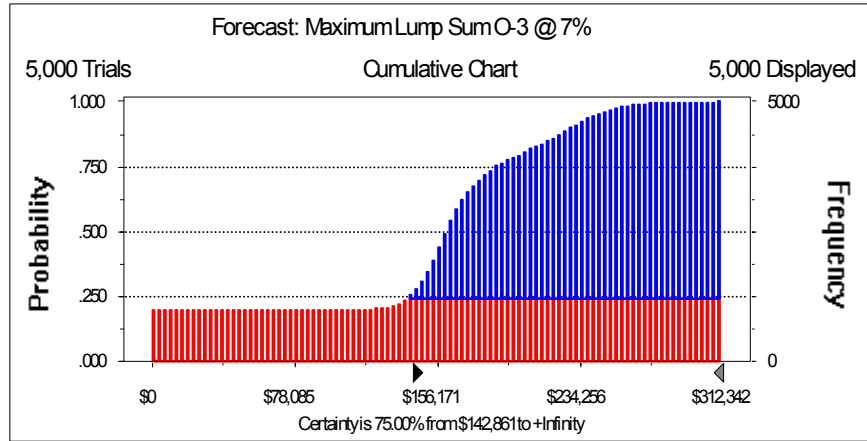
Percentiles: Maximum Lump Sum Offer by Navy- O-3			
	7%	10%	13%
0%	\$0	\$0	\$0
10%	\$0	\$0	\$0
20%	\$0	\$0	\$0
30%	\$148,650	\$65,991	\$31,364
40%	\$156,634	\$70,657	\$33,988
50%	\$162,782	\$74,342	\$36,520
60%	\$169,991	\$78,525	\$39,254
70%	\$181,113	\$84,840	\$43,491
80%	\$204,811	\$99,386	\$53,416
90%	\$231,070	\$117,152	\$64,341
100%	\$312,342	\$172,925	\$110,728

FREQUENCY GRAPHS FOR NAVY'S MAXIMUM LUMP SUM INCENTIVE OFFER - O-3



CUMULATIVE GRAPHS FOR NAVY'S MAXIMUM LUMP SUM INCENTIVE OFFER - O-3

Red shaded area represents total offer required to ensure 25% of O-3s separate

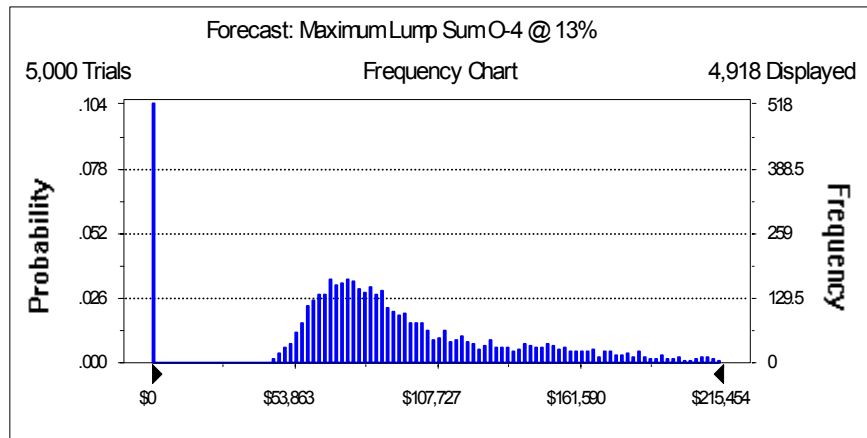
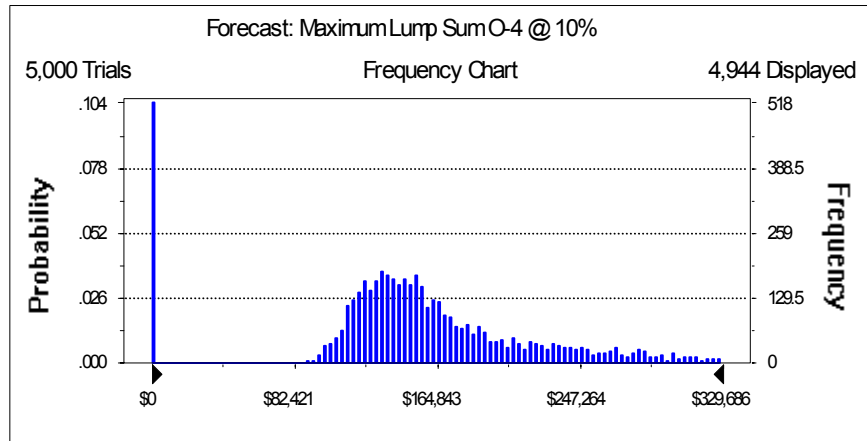
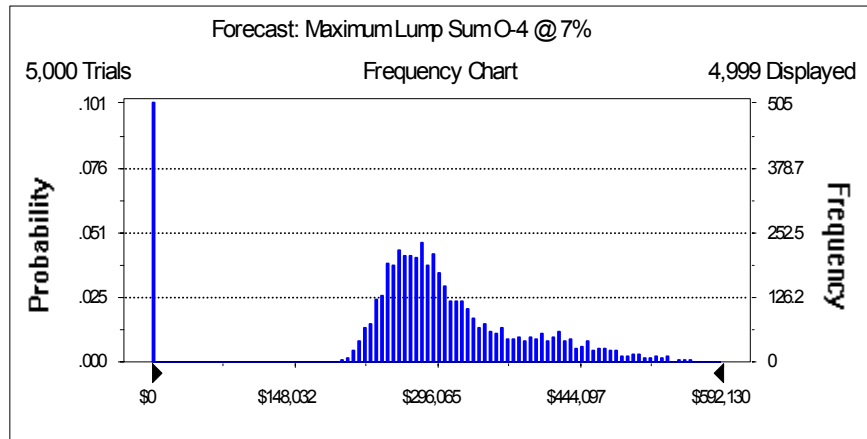


2. Lieutenant Commander (O-4)

Statistics: Maximum Lump Sum Offer by Navy - O-4			
Discount Rate	7%	10%	13%
Trials	5,000	5,000	5,000
Mean	\$282,608	\$152,954	\$90,384
Median	\$285,576	\$149,334	\$83,325
Mode	\$0	\$0	\$0
Standard Deviation	\$117,238	\$72,807	\$49,745
Variance	\$13,744,805,346	\$5,300,883,628	\$2,474,584,166
Skewness	-0.88	-0.12	0.48
Kurtosis	4.3	3.82	3.88
Coeff. of Variability	0.41	0.48	0.55
Range Minimum	\$0	\$0	\$0
Range Maximum	\$609,919	\$406,992	\$305,450
Range Width	\$609,919	\$406,992	\$305,450
Mean Std. Error	\$1,658.00	\$1,029.65	\$703.50

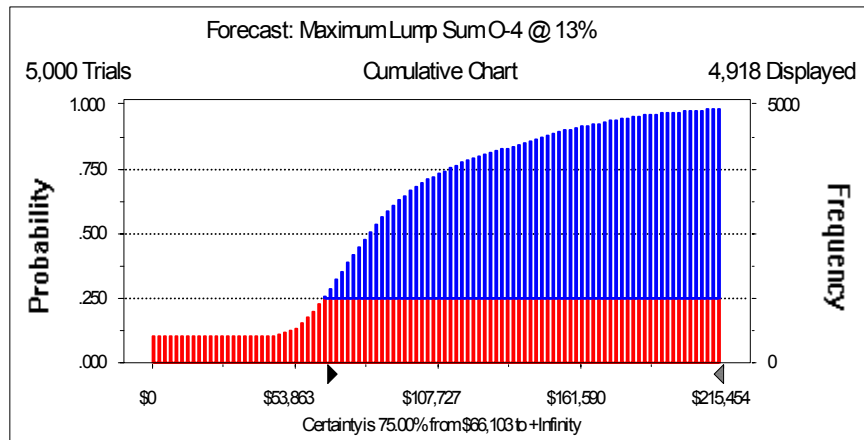
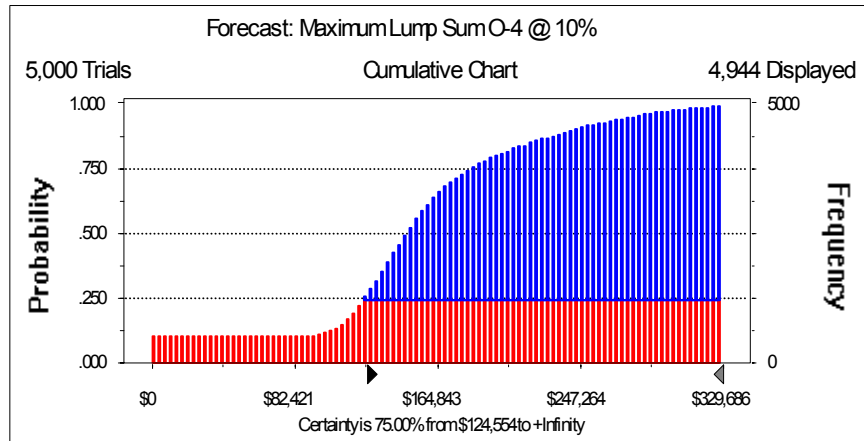
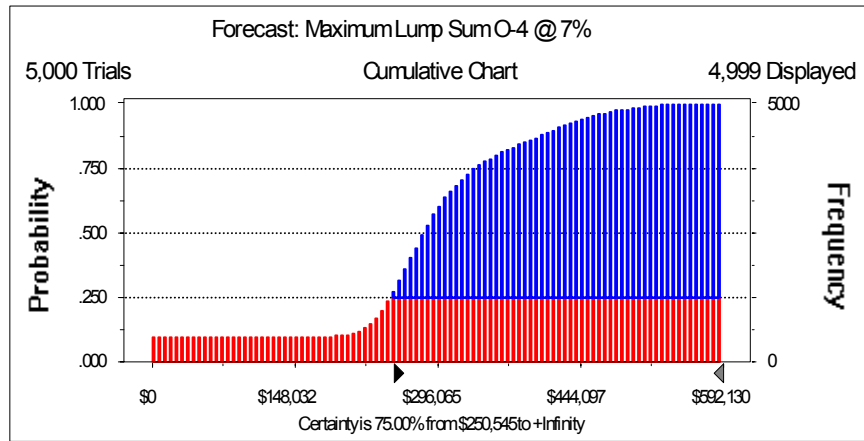
Percentiles: Maximum Lump Sum Offer by Navy- O-4			
	7%	10%	13%
0%	\$0	\$0	\$0
10%	\$0	\$0	\$0
20%	\$242,912	\$119,010	\$62,289
30%	\$257,948	\$130,135	\$69,548
40%	\$272,051	\$139,192	\$76,193
50%	\$285,576	\$149,334	\$83,325
60%	\$301,134	\$159,980	\$91,604
70%	\$323,855	\$175,241	\$103,864
80%	\$362,384	\$201,807	\$126,354
90%	\$422,336	\$245,372	\$158,131
100%	\$609,919	\$406,992	\$305,450

FREQUENCY GRAPHS FOR NAVY'S MAXIMUM LUMP SUM INCENTIVE OFFER - O-4



CUMULATIVE GRAPHS FOR NAVY'S MAXIMUM LUMP SUM INCENTIVE OFFER - O-4

Red shaded area represents total offer required to ensure 25% of O-4s separate

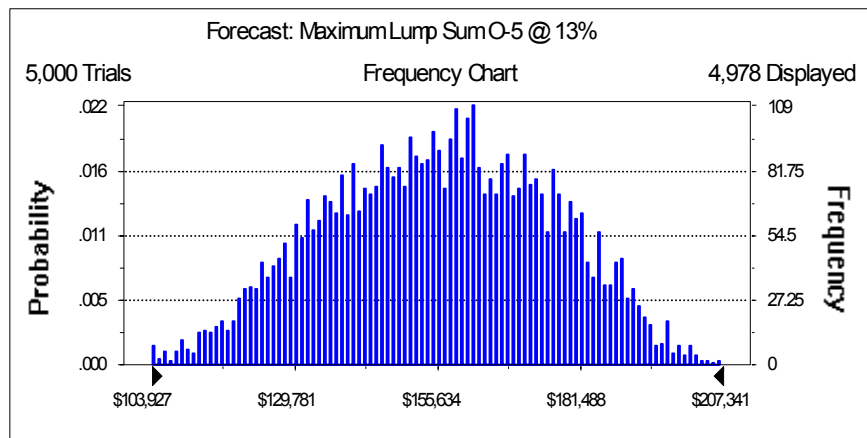
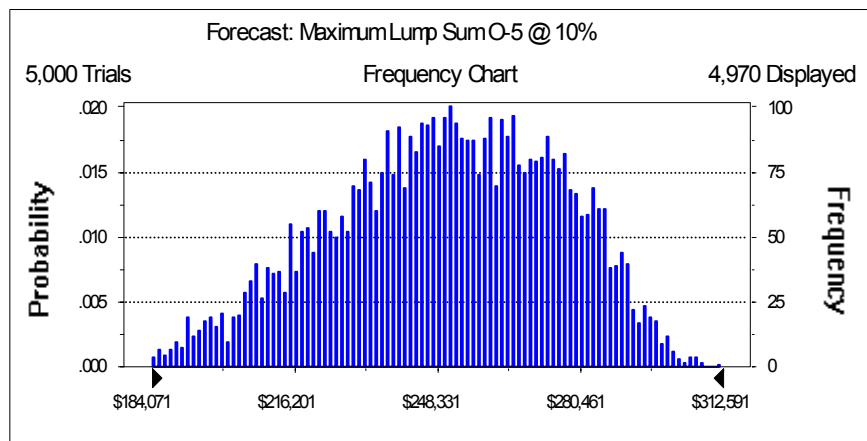
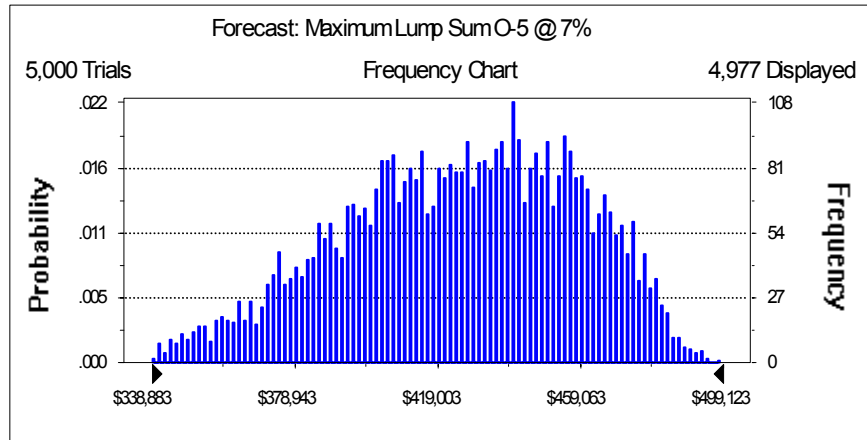


3. Commander (O-5)

Statistics: Maximum Lump Sum Offer by Navy - O-5			
Discount Rate	7%	10%	13%
Trials	5,000	5,000	5,000
Mean	\$425,033	\$249,894	\$155,771
Median	\$427,482	\$251,384	\$156,327
Mode	---	---	---
Standard Deviation	\$33,309	\$25,759	\$20,477
Variance	\$1,109,515,802	\$663,523,568	\$419,321,184
Skewness	-32%	-0.3	-0.11
Kurtosis	247%	2.51	2.44
Coeff. of Variability	8%	0.1	0.13
Range Minimum	\$319,050	\$171,693	\$93,548
Range Maximum	\$499,123	\$312,591	\$210,562
Range Width	\$180,073	\$140,899	\$117,014
Mean Std. Error	\$471.07	\$364.29	\$289.59

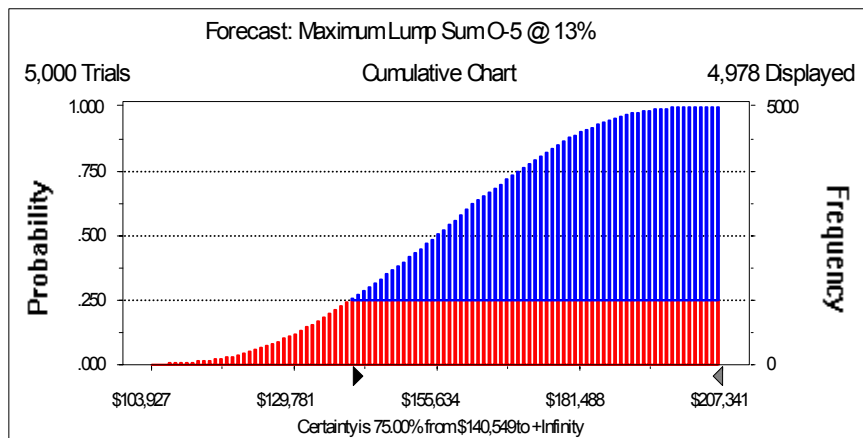
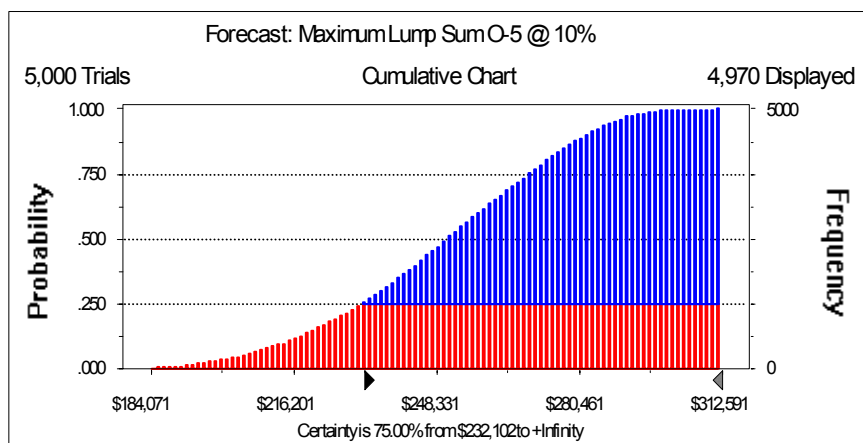
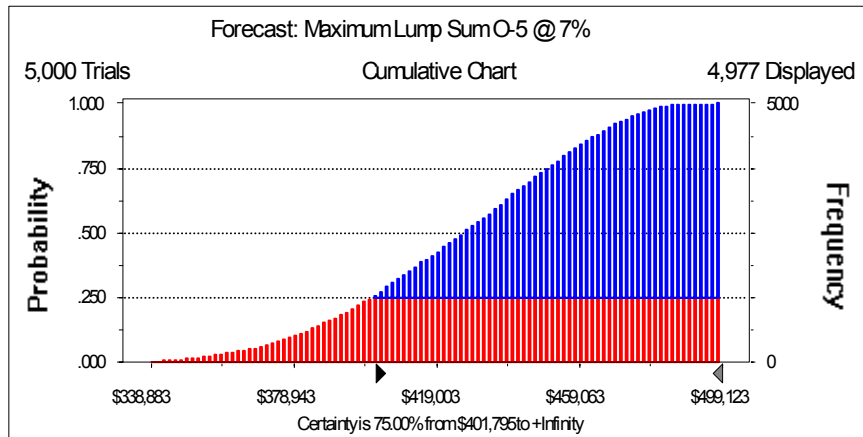
Percentiles: Maximum Lump Sum Offer by Navy- O-5			
	7%	10%	13%
0%	\$319,050	\$171,693	\$93,548
10%	\$379,450	\$214,663	\$128,352
20%	\$395,266	\$227,154	\$137,031
30%	\$406,843	\$236,631	\$144,182
40%	\$417,299	\$244,398	\$150,572
50%	\$427,482	\$251,384	\$156,327
60%	\$437,050	\$258,627	\$161,836
70%	\$446,412	\$265,863	\$168,026
80%	\$456,135	\$273,851	\$174,545
90%	\$467,404	\$282,890	\$182,395
100%	\$499,123	\$312,591	\$210,562

FREQUENCY GRAPHS FOR NAVY'S MAXIMUM LUMP SUM INCENTIVE OFFER - O-5



CUMULATIVE GRAPHS FOR NAVY'S MAXIMUM LUMP SUM INCENTIVE OFFER - O-5

Red shaded area represents total offer required to ensure 25% of O-5s separate



B. THEORETICAL VSI (ANNUITY) PRESENT VALUE

1. Lieutenant (O-3)

Statistics: Theoretical Annuity (VSI) Present Value - O-3			
Discount Rate	7%	10%	13%
Trials	5,000	500000%	5,000
Mean	\$127,551	\$101,431	\$85,012
Median	\$106,875	\$87,720	\$73,933
Mode	---	---	---
Standard Deviation	\$56,419	\$41,376	\$32,255
Variance	\$3,183,079,986	\$1,712,000,132	\$1,040,413,306
Skewness	96%	0.96	0.88
Kurtosis	276%	2.78	2.63
Coeff. of Variability	44%	0.41	0.38
Range Minimum	\$62,762	\$53,811	\$46,667
Range Maximum	\$287,581	\$217,630	\$172,310
Range Width	\$224,819	\$163,819	\$125,644
Mean Std. Error	\$797.88	\$585.15	\$456.16

Percentiles: Theoretical Annuity (VSI) Present Value - O-3			
	7%	10%	13%
0%	\$62,762	\$53,811	\$46,667
10%	\$68,469	\$57,549	\$49,370
20%	\$82,732	\$68,941	\$58,872
30%	\$84,822	\$70,412	\$59,853
40%	\$104,173	\$71,754	\$72,832
50%	\$106,875	\$87,720	\$73,933
60%	\$110,517	\$89,870	\$84,711
70%	\$152,547	\$120,934	\$100,575
80%	\$177,941	\$139,419	\$113,265
90%	\$210,769	\$163,103	\$131,631
100%	\$287,581	\$217,630	\$172,310

2. Lieutenant Commander (O-4)

Statistics: Theoretical Annuity (VSI) Present Value - O-4			
Discount Rate	7%	10%	13%
Trials	5,000	5,000	5,000
Mean	\$275,162	\$209,659	\$168,524
Median	\$259,587	\$200,516	\$161,095
Mode	---	---	---
Standard Deviation	\$83,184	\$56,750	\$43,838
Variance	\$6,919,506,769	\$3,220,515,823	\$1,921,728,077
Skewness	0.48	0.43	0.37
Kurtosis	2.14	2.18	2.05
Coeff. of Variability	0.3	0.27	0.26
Range Minimum	\$135,545	\$110,470	\$92,060
Range Maximum	\$437,006	\$316,029	\$245,486
Range Width	\$301,462	\$205,559	\$153,426
Mean Std. Error	\$1,176.39	\$802.56	\$619.96

Percentiles: Theoretical Annuity (VSI) Present Value - O-4			
	7%	10%	13%
0%	\$135,545	\$110,470	\$92,060
10%	\$174,552	\$139,133	\$113,890
20%	\$197,661	\$155,985	\$126,935
30%	\$231,628	\$181,225	\$146,672
40%	\$235,675	\$183,169	\$147,692
50%	\$259,587	\$200,516	\$161,095
60%	\$264,256	\$202,590	\$180,337
70%	\$322,060	\$228,130	\$194,654
80%	\$360,202	\$269,541	\$213,220
90%	\$420,250	\$310,808	\$243,759
100%	\$437,006	\$316,029	\$245,486

3. Commander (O-5)

Statistics: Theoretical Annuity (VSI) Present Value - O-5			
Discount Rate	7%	10%	13%
Trials	5,000	5,000	5,000
Mean	\$422,506	\$315,443	\$248,225
Median	\$424,775	\$316,354	\$248,805
Mode	\$465,514	\$345,568	\$271,335
Standard Deviation	\$34,774	\$24,897	\$18,789
Variance	\$1,209,240,475	\$619,843,990	\$353,018,258
Skewness	-0.56	-0.56	-0.52
Kurtosis	2.97	2.93	2.94
Coeff. of Variability	0.08	0.08	0.08
Range Minimum	\$338,054	\$256,764	\$204,133
Range Maximum	\$465,514	\$345,568	\$271,335
Range Width	\$127,460	\$88,804	\$67,202
Mean Std. Error	\$491.78	\$352.09	\$265.71

Percentiles: Theoretical Annuity (VSI) Present Value - O-5			
	7%	10%	13%
0%	\$338,054	\$256,764	\$204,133
10%	\$391,369	\$294,396	\$232,852
20%	\$394,241	\$295,643	\$233,323
30%	\$396,503	\$296,496	\$233,671
40%	\$423,164	\$315,803	\$248,558
50%	\$424,775	\$316,354	\$248,805
60%	\$426,060	\$316,875	\$249,000
70%	\$427,281	\$317,341	\$249,180
80%	\$465,514	\$345,568	\$271,335
90%	\$465,514	\$345,568	\$271,335
100%	\$465,514	\$345,568	\$271,335

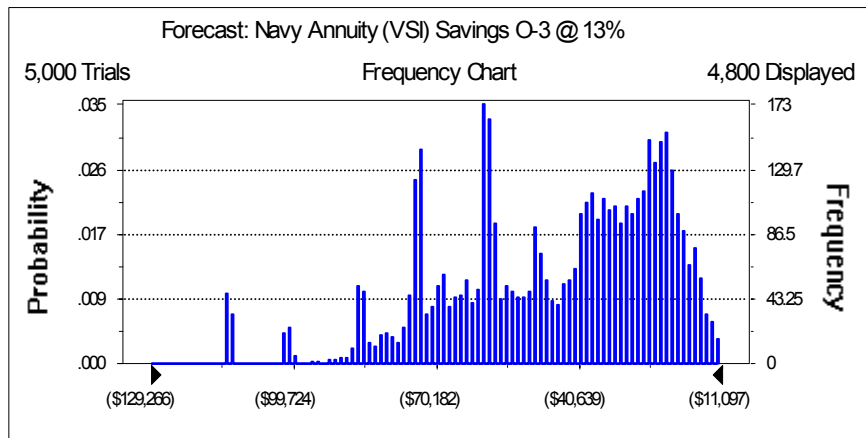
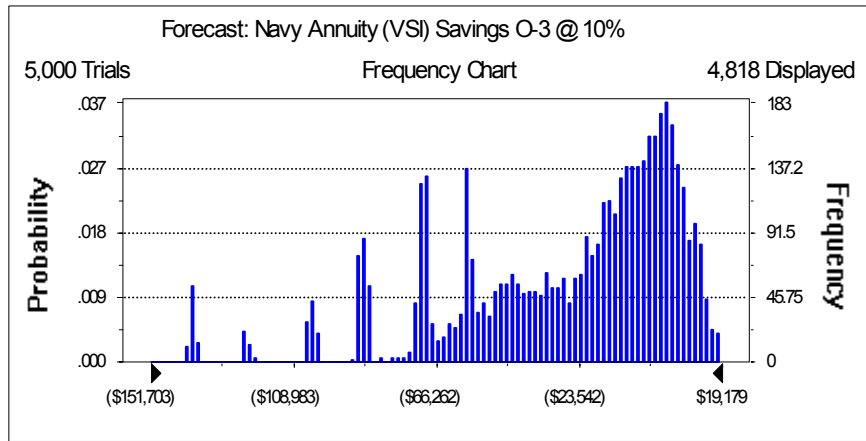
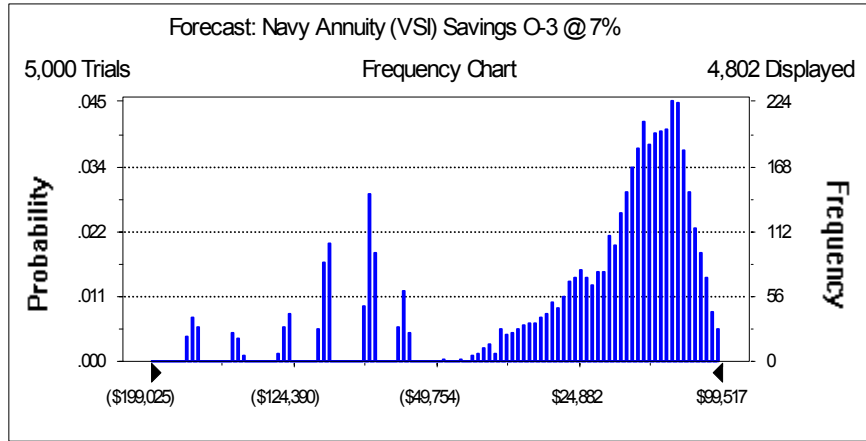
C. NAVY ANNUITY SAVINGS: COMPARISON OF THEORETICAL VSI AND MAXIMUM OFFER AMOUNT BY NAVY

1. Lieutenant (O-3)

Statistics: Navy Annuity (VSI) Savings - O-3			
Discount Rate	7%	10%	13%
Trials	5,000	5,000	5,000
Mean	\$17,406	(\$32,556)	(\$49,400)
Median	\$51,458	(\$16,993)	(\$41,509)
Mode	---	---	---
Standard Deviation	\$80,970	\$43,843	\$29,080
Variance	\$6,556,074,382	\$1,922,169,042	\$845,633,847
Skewness	-1.57	-1.59	-1.48
Kurtosis	4.64	5.65	5.67
Coeff. of Variability	4.65	-1.35	-0.59
Range Minimum	(\$287,581)	(\$217,630)	(\$172,310)
Range Maximum	\$106,021	\$23,435	(\$9,685)
Range Width	\$393,602	\$241,065	\$162,625
Mean Std. Error	\$1,145.08	\$620.03	\$411.25

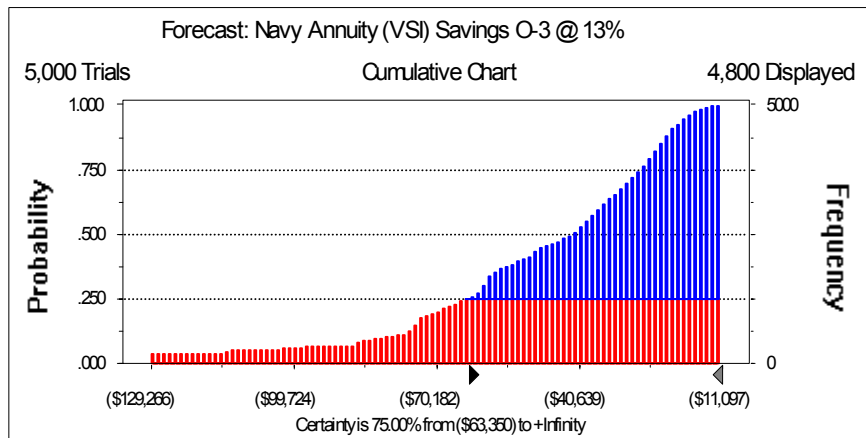
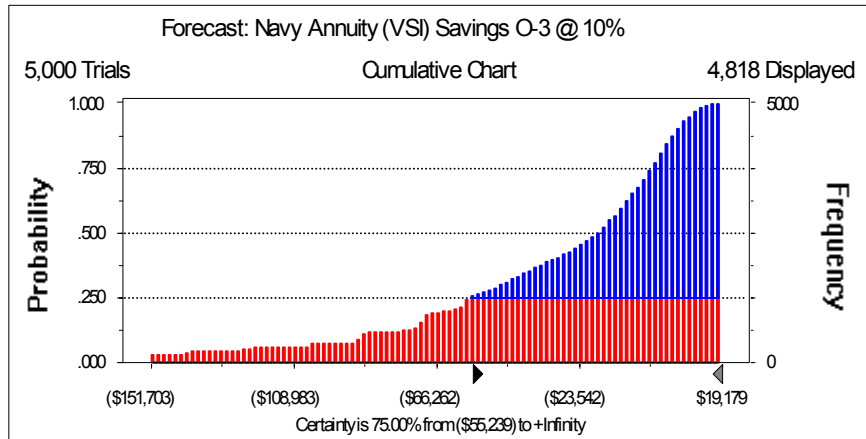
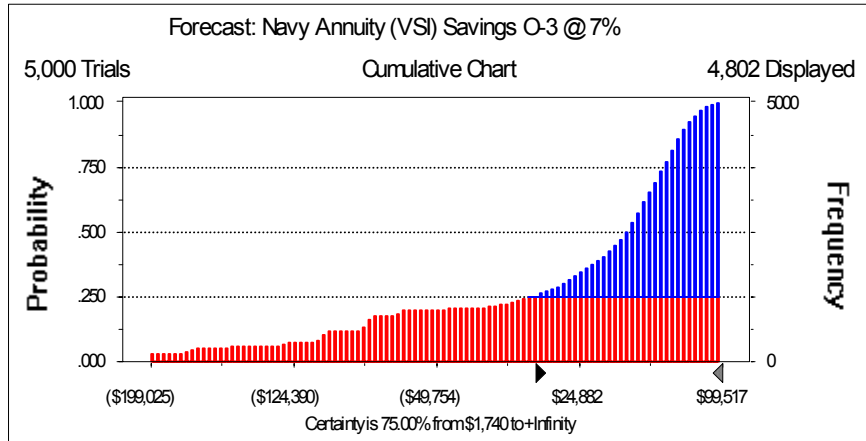
Percentiles: Navy Annuity (VSI) Savings - O-3			
	7%	10%	13%
0%	(\$287,581)	(\$217,630)	(\$172,310)
10%	(\$106,833)	(\$87,762)	(\$81,302)
20%	(\$64,437)	(\$62,600)	(\$69,426)
30%	\$18,368	(\$45,896)	(\$59,735)
40%	\$38,937	(\$29,995)	(\$51,853)
50%	\$51,458	(\$16,993)	(\$41,509)
60%	\$59,758	(\$9,399)	(\$35,562)
70%	\$67,440	(\$3,333)	(\$29,766)
80%	\$74,378	\$1,803	(\$24,954)
90%	\$81,879	\$7,024	(\$20,800)
100%	\$106,021	\$23,435	(\$9,685)

FREQUENCY GRAPHS FOR NAVY ANNUITY (VSI) SAVINGS - O-3



CUMULATIVE GRAPHS FOR NAVY ANNUITY (VSI) SAVINGS - O-3

Red shaded area represents Navy savings from least expensive 25% of O-3

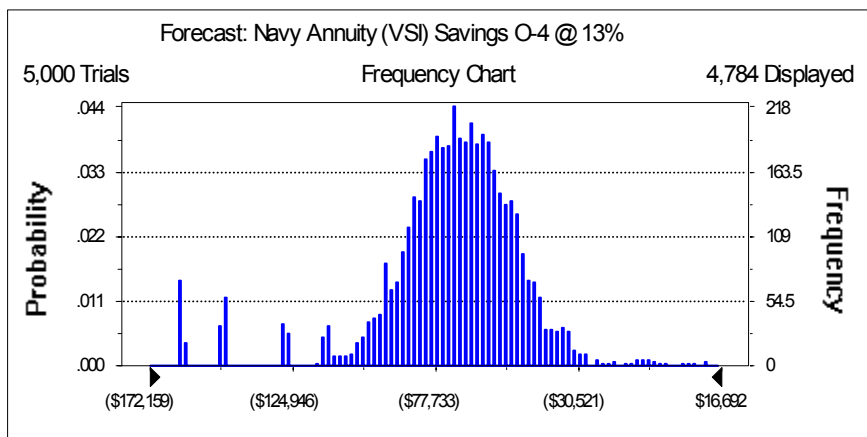
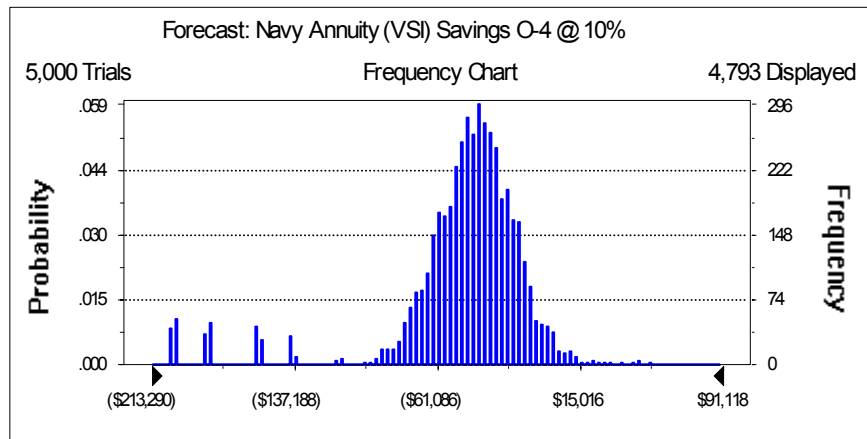
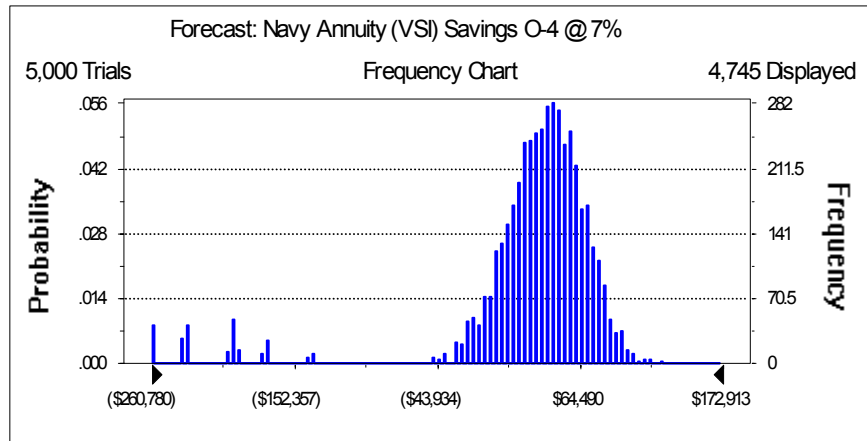


2. Lieutenant Commander (O-4)

Statistics: Navy Annuity (VSI) Savings - O-4			
Discount Rate	7%	10%	13%
Trials	5,000	5,000	5,000
Mean	\$7,446	(\$56,705)	(\$78,140)
Median	\$36,118	(\$42,129)	(\$70,843)
Mode	---	---	---
Standard Deviation	\$102,232	\$58,890	\$37,944
Variance	\$10,451,473,458	\$3,468,013,503	\$1,439,747,517
Skewness	-2.64	-2.45	-219%
Kurtosis	9.4	9.37	943%
Coeff. of Variability	13.73	-1.04	-49%
Range Minimum	(\$435,113)	(\$315,557)	(\$245,338)
Range Maximum	\$172,913	\$91,118	\$59,968
Range Width	\$608,026	\$406,674	\$305,306
Mean Std. Error	\$1,445.79	\$832.83	\$536.61

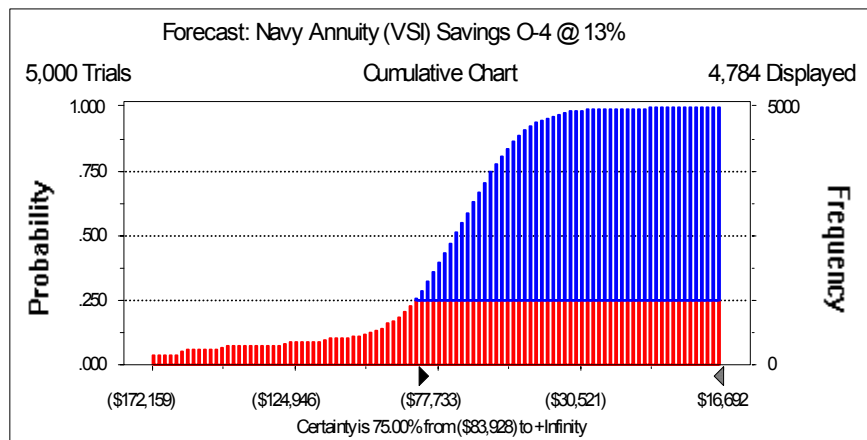
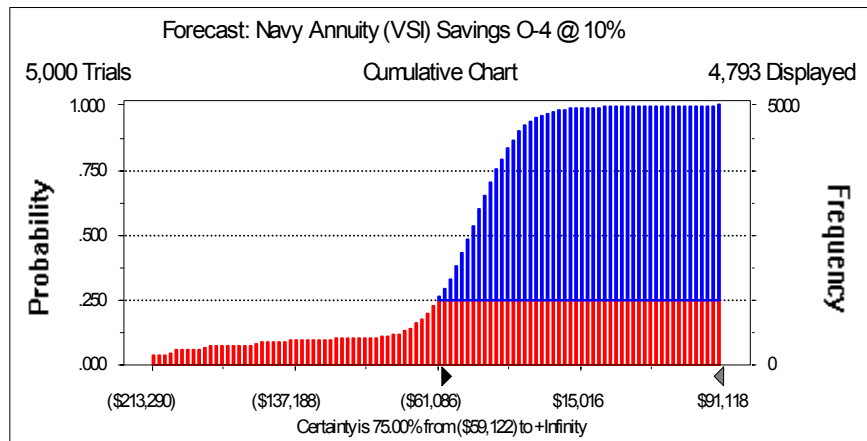
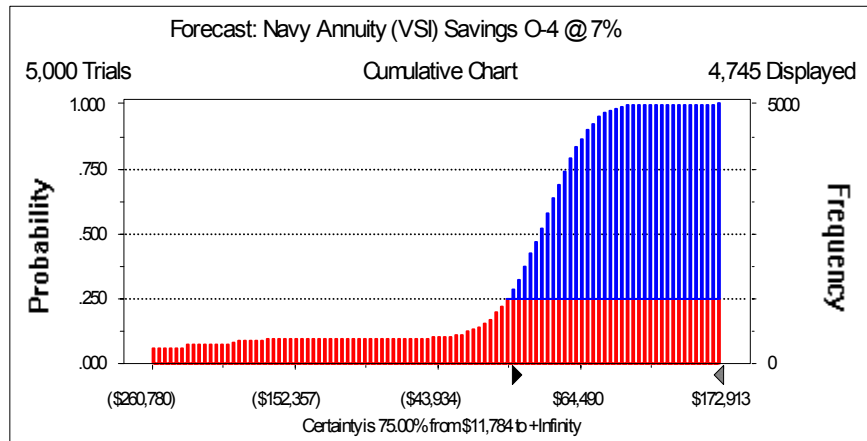
Percentiles: Navy Annuity (VSI) Savings - O-4			
	7%	10%	13%
0%	(\$435,113)	(\$315,557)	(\$245,338)
10%	(\$137,834)	(\$136,623)	(\$112,966)
20%	\$4,128	(\$64,179)	(\$87,919)
30%	\$18,130	(\$54,887)	(\$80,700)
40%	\$27,663	(\$47,510)	(\$75,685)
50%	\$36,118	(\$42,129)	(\$70,843)
60%	\$44,381	(\$36,682)	(\$65,878)
70%	\$52,206	(\$31,087)	(\$61,184)
80%	\$61,042	(\$24,072)	(\$55,647)
90%	\$72,897	(\$15,509)	(\$48,422)
100%	\$172,913	\$91,118	\$59,968

FREQUENCY GRAPHS FOR NAVY ANNUITY (VSI) SAVINGS - O-4



CUMULATIVE GRAPHS FOR NAVY ANNUITY (VSI) SAVINGS - O-4

Red shaded area represents Navy savings from least expensive 25% of O-4s

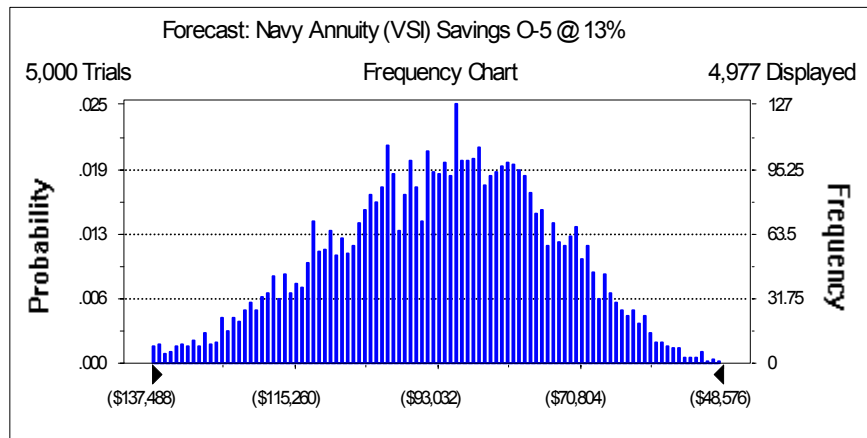
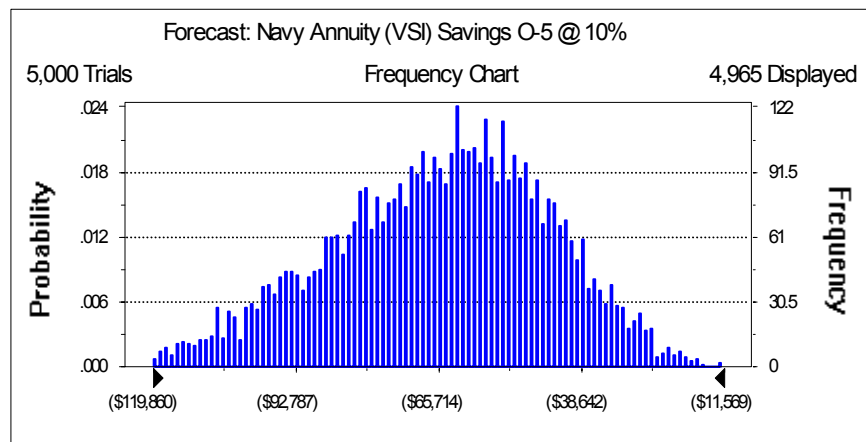
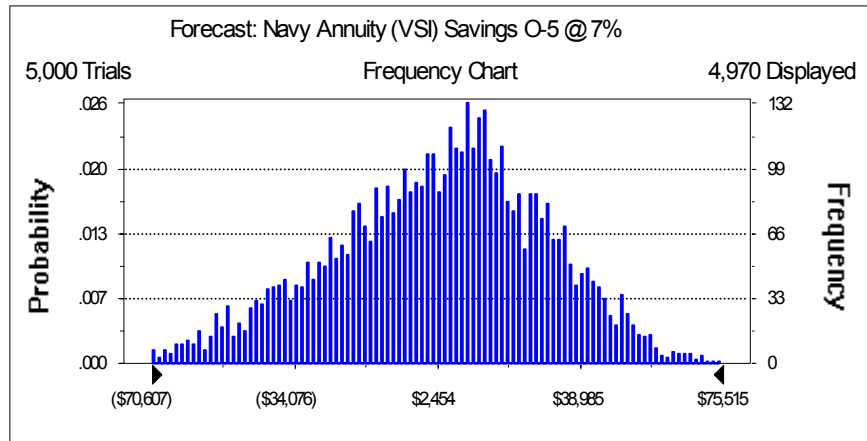


3. Commander (O-5)

Statistics: Navy Annuity (VSI) Savings - O-5			
Discount Rate	7%	10%	13%
Trials	5,000	5,000	5,000
Mean	\$2,527	(\$65,549)	(\$92,454)
Median	\$5,100	(\$63,584)	(\$91,360)
Mode	---	---	---
Standard Deviation	\$27,504	\$21,012	\$17,109
Variance	\$756,481,052	\$441,492,199	\$292,700,884
Skewness	-0.31	-0.33	-0.23
Kurtosis	2.8	2.75	2.69
Coeff. of Variability	10.88	-0.32	-0.19
Range Minimum	(\$83,307)	(\$136,157)	(\$149,444)
Range Maximum	\$76,778	(\$10,679)	(\$41,901)
Range Width	\$160,085	\$125,479	\$107,543
Mean Std. Error	\$388.97	\$297.15	\$241.95

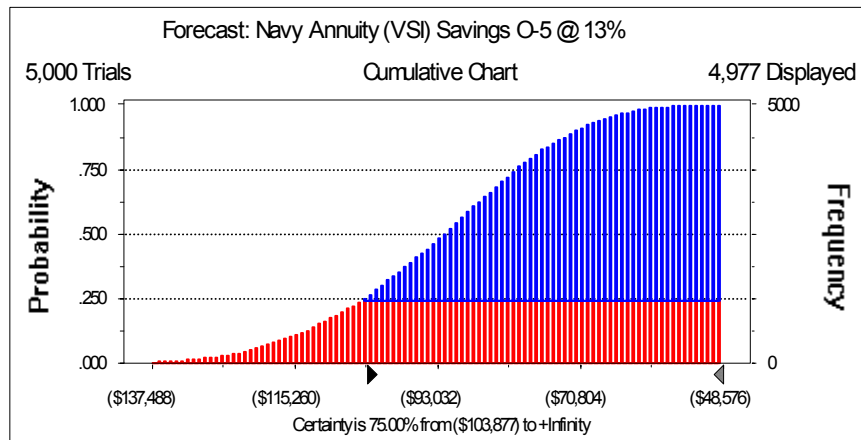
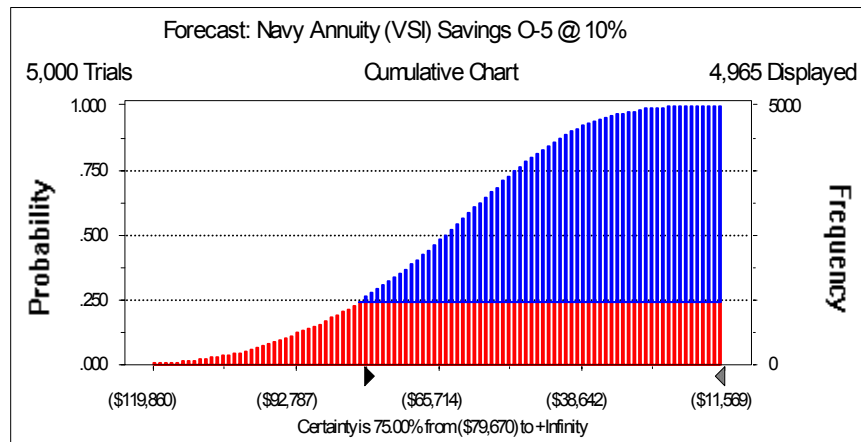
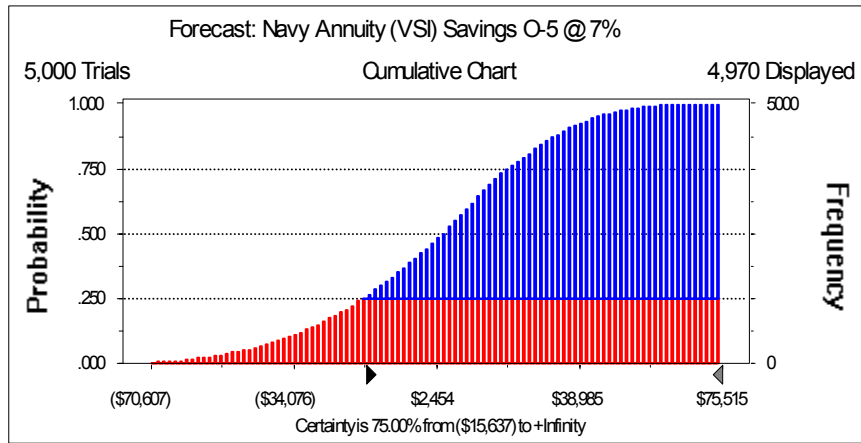
Percentiles: Navy Annuity (VSI) Savings - O-5			
	7%	10%	13%
0%	(\$83,307)	(\$136,157)	(\$149,444)
10%	(\$35,928)	(\$94,650)	(\$115,857)
20%	(\$20,813)	(\$83,744)	(\$107,343)
30%	(\$10,775)	(\$76,054)	(\$101,191)
40%	(\$2,443)	(\$69,443)	(\$96,169)
50%	\$5,100	(\$63,584)	(\$91,360)
60%	\$11,431	(\$58,582)	(\$87,017)
70%	\$17,702	(\$53,096)	(\$82,421)
80%	\$26,441	(\$47,216)	(\$77,664)
90%	\$36,509	(\$39,720)	(\$70,813)
100%	\$76,778	(\$10,679)	(\$41,901)

FREQUENCY GRAPHS FOR NAVY ANNUITY (VSI) SAVINGS - O-5



CUMULATIVE GRAPHS FOR NAVY ANNUITY (VSI) SAVINGS - O-5

Red shaded area represents Navy savings from least expensive 25% of O-5s



D. THEORETICAL SSB (LUMP SUM)

1. Lieutenant (O-3)

Statistics: Theoretical Lump Sum (SSB) - O-3			
Discount Rate	7%	10%	13%
Trials	5,000	5,000	5,000
Mean	\$73,595	\$72,999	\$73,800
Median	\$66,049	\$66,049	\$66,049
Mode	\$55,034	\$55,034	\$55,034
Standard Deviation	\$23,393	\$23,271	\$23,441
Variance	\$547,225,458	\$541,532,310	\$549,492,505
Skewness	0.89	0.93	0.88
Kurtosis	2.65	2.75	2.65
Coeff. of Variability	0.32	0.32	0.32
Range Minimum	\$47,172	\$47,172	\$47,172
Range Maximum	\$137,246	\$137,246	\$137,246
Range Width	\$90,074	\$90,074	\$90,074
Mean Std. Error	\$330.82	\$329.10	\$331.51

Percentiles: Theoretical Lump Sum (SSB) - O-3			
	7%	10%	13%
0%	47,172	\$47,172	\$47,172
10%	\$47,172	\$47,172	\$47,172
20%	\$55,034	\$55,034	\$55,034
30%	\$55,034	\$55,034	\$55,034
40%	\$66,049	\$55,034	\$66,049
50%	\$66,049	\$66,049	\$66,049
60%	\$66,049	\$66,049	\$74,305
70%	\$85,115	\$85,115	\$85,115
80%	\$93,626	\$93,626	\$93,626
90%	\$107,181	\$107,181	\$107,181
100%	\$137,246	\$137,246	\$137,246

2. Lieutenant Commander (O-4)

Statistics: Theoretical Lump Sum (SSB) - O-4			
Discount Rate	7%	10%	13%
Trials	5,000	5,000	5,000
Mean	\$135,760	\$135,450	\$136,195
Median	\$130,637	\$130,637	\$130,637
Mode	\$120,588	\$120,588	\$120,588
Standard Deviation	\$32,215	\$31,584	\$32,429
Variance	\$1,037,784,875	\$997,545,427	\$1,051,654,059
Skewness	0.4	0.41	0.37
Kurtosis	2.09	2.16	2.05
Coeff. of Variability	0.24	0.23	0.24
Range Minimum	\$80,638	\$80,638	\$80,638
Range Maximum	\$192,251	\$192,251	\$192,251
Range Width	\$111,613	\$111,613	\$111,613
Mean Std. Error	\$455.58	\$446.66	\$458.62

Percentiles: Theoretical Lump Sum (SSB) - O-4			
	7%	10%	13%
0%	\$80,638	\$80,638	\$80,638
10%	\$95,717	\$95,717	\$95,717
20%	\$105,289	\$105,289	\$105,289
30%	\$120,588	\$120,588	\$120,588
40%	\$120,588	\$120,588	\$120,588
50%	\$130,637	\$130,637	\$130,637
60%	\$130,637	\$130,637	\$145,319
70%	\$155,698	\$145,319	\$155,698
80%	\$169,119	\$169,119	\$169,119
90%	\$192,251	\$192,251	\$192,251
100%	\$192,251	\$192,251	\$192,251

3. Commander (O-5)

Statistics: Theoretical Lump Sum (SSB) - O-5			
Discount Rate	7%	10%	13%
Trials	5,000	5,000	5,000
Mean	\$196,350	\$196,543	\$196,501
Median	\$196,791	\$196,791	\$196,791
Mode	\$196,791	\$196,791	\$196,791
Standard Deviation	\$14,240	\$14,512	\$14,375
Variance	\$202,774,435	\$210,595,072	\$206,647,383
Skewness	-0.52	-0.54	-0.51
Kurtosis	3.02	2.95	2.94
Coeff. of Variability	0.07	0.07	0.07
Range Minimum	\$163,311	\$163,311	\$163,311
Range Maximum	\$214,272	\$214,272	\$214,272
Range Width	\$50,962	\$50,962	\$50,962
Mean Std. Error	\$201.38	\$205.23	\$203.30

Percentiles: Theoretical Lump Sum (SSB) - O-5			
	7%	10%	13%
0%	\$163,311	\$163,311	\$163,311
10%	\$185,215	\$185,215	\$185,215
20%	\$185,215	\$185,215	\$185,215
30%	\$185,215	\$185,215	\$185,215
40%	\$196,791	\$196,791	\$196,791
50%	\$196,791	\$196,791	\$196,791
60%	\$196,791	\$196,791	\$196,791
70%	\$196,791	\$196,791	\$196,791
80%	\$214,272	\$214,272	\$214,272
90%	\$214,272	\$214,272	\$214,272
100%	\$214,272	\$214,272	\$214,272

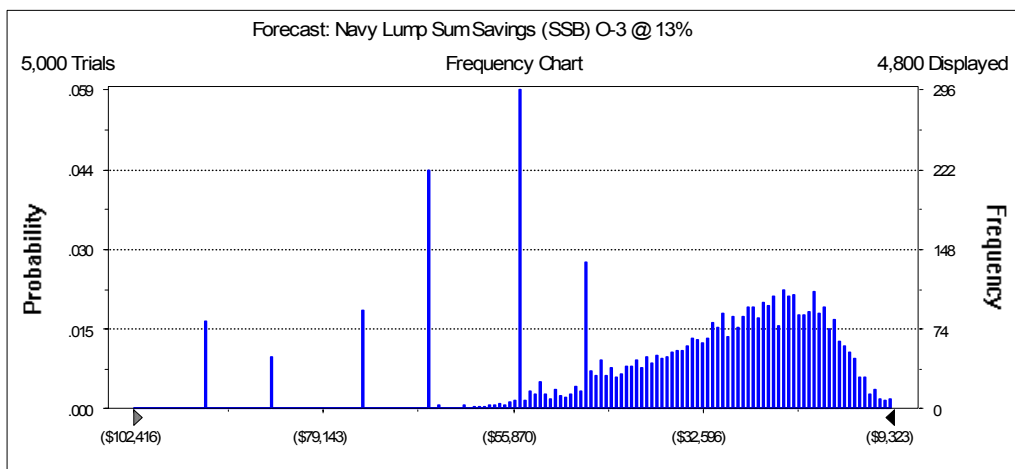
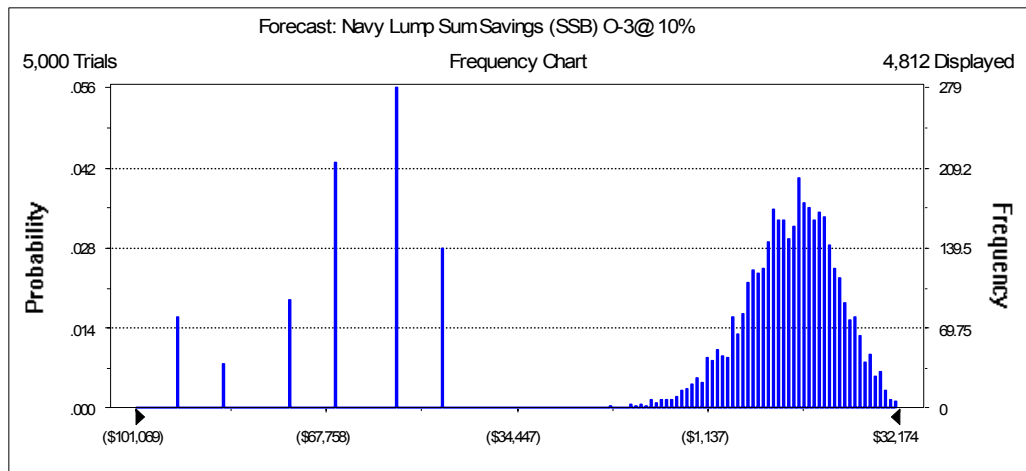
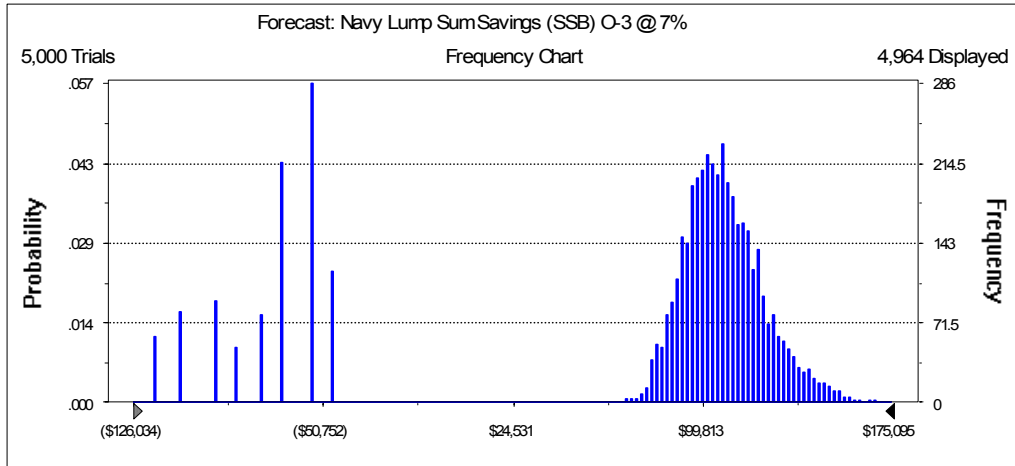
E. NAVY LUMP SUM SAVINGS: COMPARISON OF THEORETICAL SSB AND MAXIMUM OFFER AMOUNT BY NAVY

1. Lieutenant (O-3)

Statistics: Navy Lump Sum (SSB) Savings - O-3			
Discount Rate	7%	10%	13%
Trials	5,000	5,000	5,000
Mean	\$71,362	(\$4,124)	(\$38,188)
Median	\$102,002	\$11,200	(\$30,961)
Mode	(\$55,034)	(\$55,034)	(\$55,034)
Standard Deviation	\$75,187	\$36,975	\$23,395
Variance	\$5,653,078,326	\$1,367,161,132	\$547,340,539
Skewness	-1.42	(\$2)	-1.78
Kurtosis	3.38	\$5	6.37
Coeff. of Variability	1.05	(\$9)	-0.61
Range Minimum	(\$137,246)	(\$137,246)	(\$137,246)
Range Maximum	\$175,095	\$37,734	(\$7,664)
Range Width	\$312,342	\$174,980	\$129,582
Mean Std. Error	\$1,063.30	\$523	\$330.86

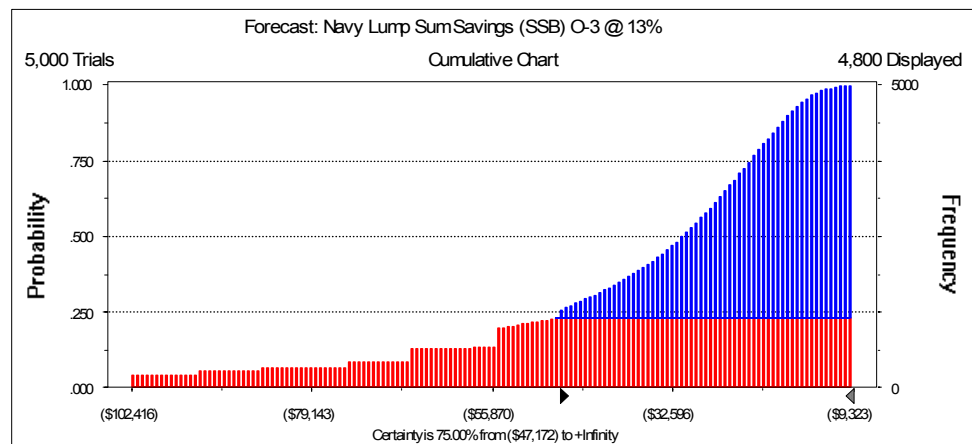
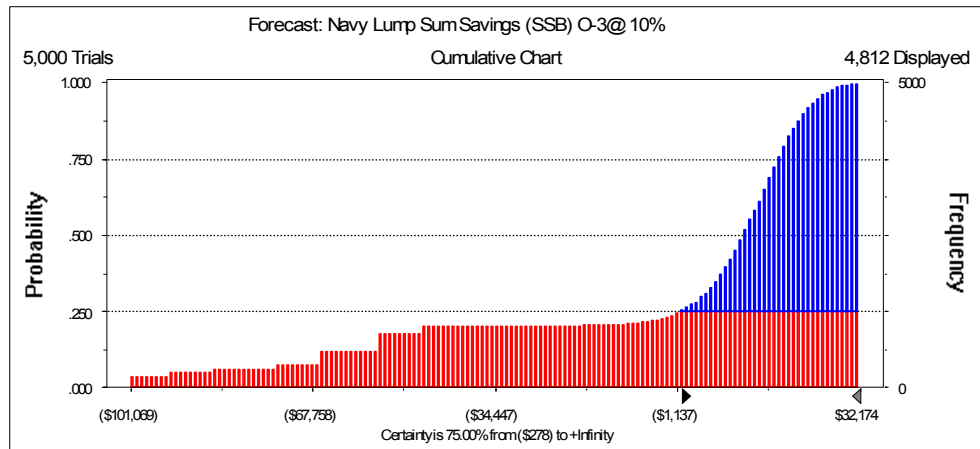
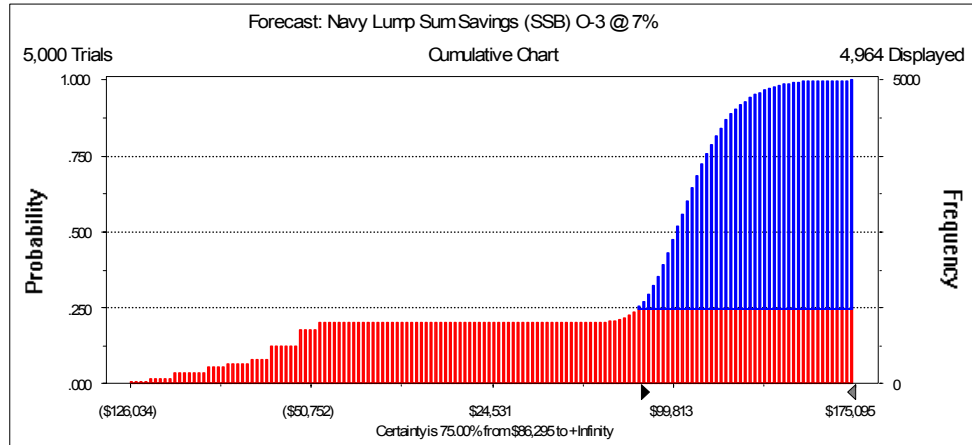
Percentiles:Navy Lump Sum (SSB) Savings - O-3			
	7%	10%	13%
0%	(\$137,246)	(\$137,246)	(\$137,246)
10%	(\$66,049)	(\$66,049)	(\$66,049)
20%	(\$47,172)	(\$47,172)	(\$53,440)
30%	\$91,170	\$3,817	(\$42,919)
40%	\$97,147	\$8,233	(\$35,823)
50%	\$102,002	\$11,200	(\$30,961)
60%	\$106,764	\$14,024	(\$27,111)
70%	\$111,498	\$16,434	(\$23,866)
80%	\$117,598	\$19,044	(\$20,680)
90%	\$126,330	\$22,402	(\$17,388)
100%	\$175,095	\$37,734	(\$7,664)

FREQUENCY GRAPHS FOR NAVY LUMP SUM (SSB) SAVINGS - O-3



CUMULATIVE GRAPHS FOR NAVY LUMP SUM (SSB) SAVINGS - O-3

Red shaded area represents Navy savings from least expensive 25% of O-3s

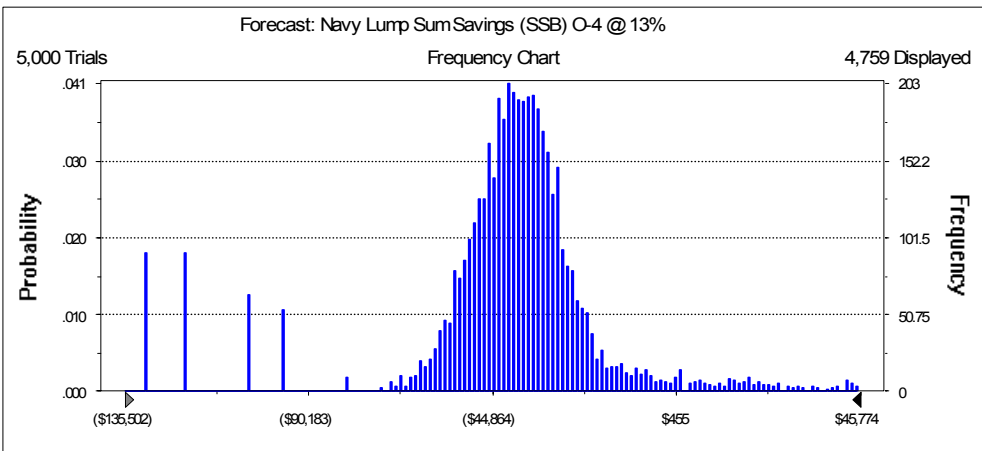
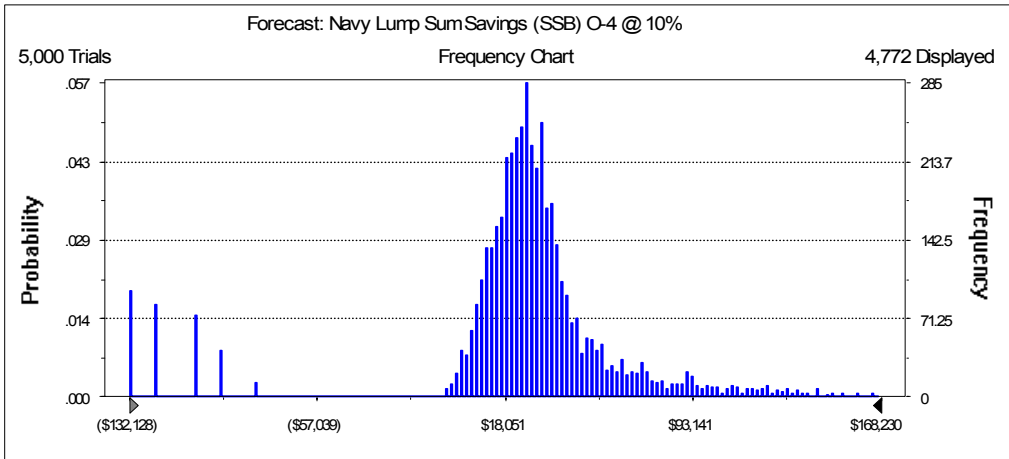
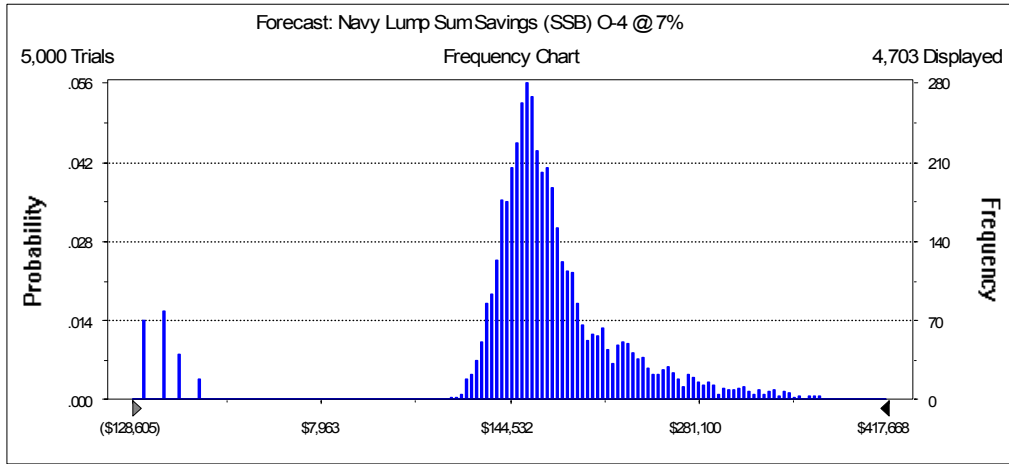


2. Lieutenant Commander (O-4)

Statistics: Navy Lump Sum (SSB) Savings - O-4			
Discount Rate	7%	10%	13%
Trials	5,000	5,000	5,000
Mean	\$146,848	\$17,504	(\$45,811)
Median	\$162,214	\$26,731	(\$39,218)
Mode	(\$130,637)	(\$130,637)	(\$130,637)
Standard Deviation	\$104,241	\$59,154	\$36,637
Variance	\$10,866,256,922	\$3,499,241,143	\$1,342,291,203
Skewness	-1.82	-163%	-1.74
Kurtosis	6.32	668%	8.3
Coeff. of Variability	0.71	338%	-0.8
Range Minimum	(\$192,251)	(\$192,251)	(\$192,251)
Range Maximum	\$417,668	\$214,741	\$113,200
Range Width	\$609,919	\$406,992	\$305,450
Mean Std. Error	\$1,474.20	\$836.57	\$518.13

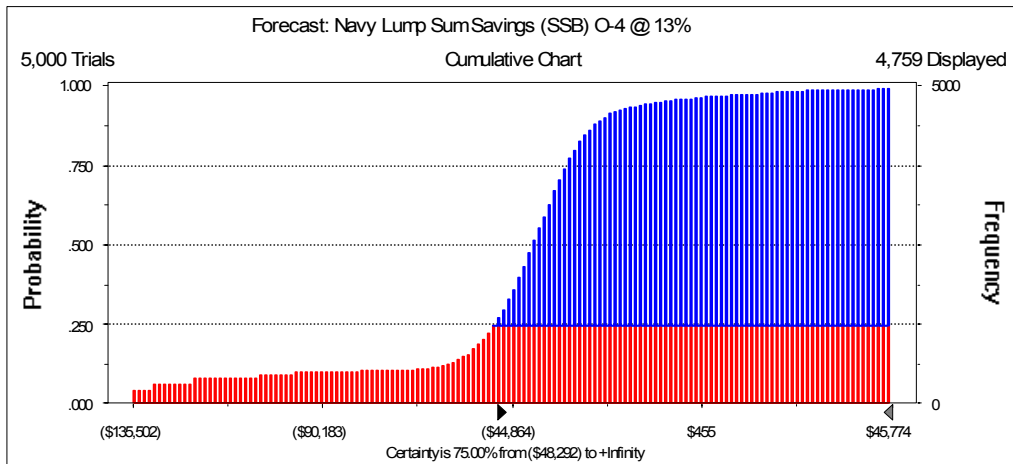
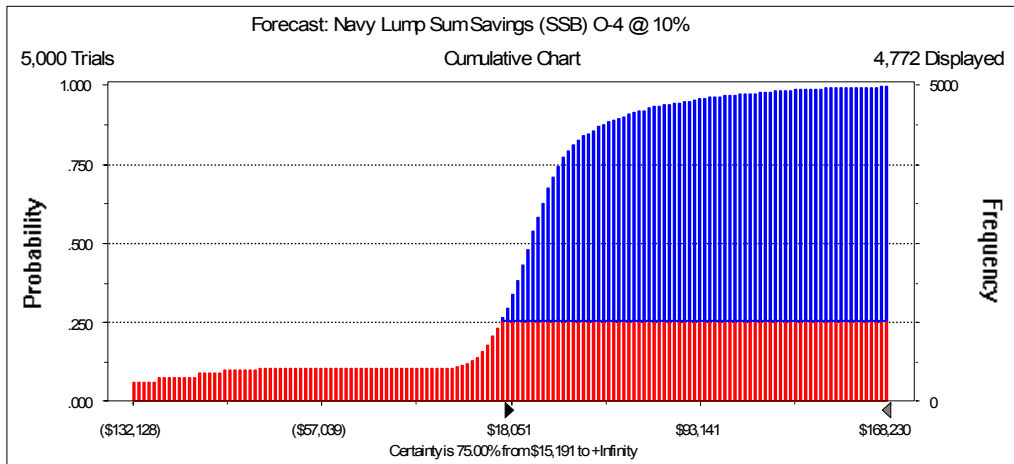
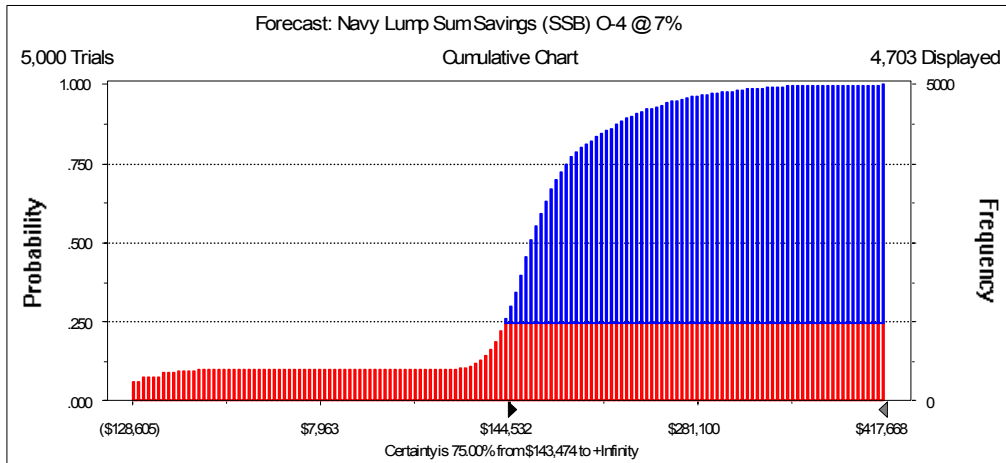
Percentiles:Navy Lump Sum (SSB) Savings - O-4			
	7%	10%	13%
0%	(\$192,251)	(\$192,251)	(\$192,251)
10%	(\$80,638)	(\$95,717)	(\$95,717)
20%	\$138,267	\$11,572	(\$51,149)
30%	\$148,132	\$18,163	(\$45,969)
40%	\$155,629	\$22,711	(\$42,359)
50%	\$162,214	\$26,731	(\$39,218)
60%	\$170,544	\$30,871	(\$36,139)
70%	\$180,740	\$35,534	(\$32,986)
80%	\$198,540	\$42,704	(\$29,032)
90%	\$234,718	\$63,137	(\$22,079)
100%	\$417,668	\$214,741	\$113,200

FREQUENCY GRAPHS FOR NAVY LUMP SUM (SSB) SAVINGS - O-4



CUMULATIVE GRAPHS FOR NAVY LUMP SUM (SSB) SAVINGS - O-4

Red shaded area represents Navy savings from least expensive 25% of O-4s

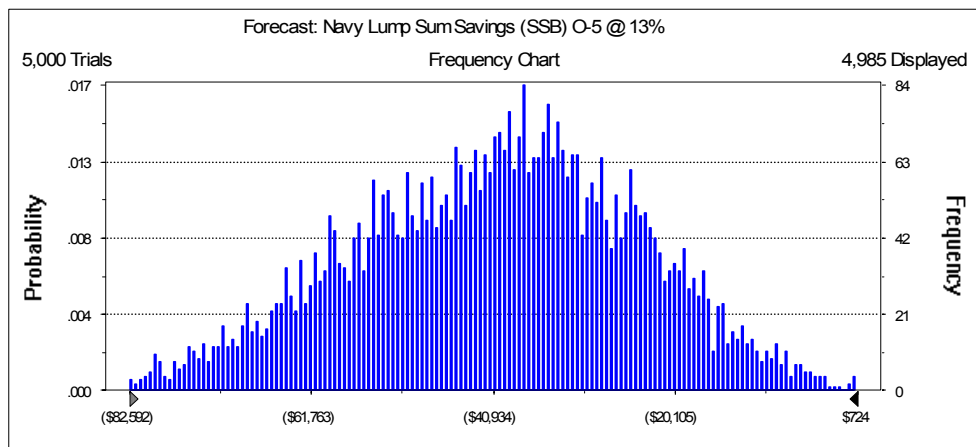
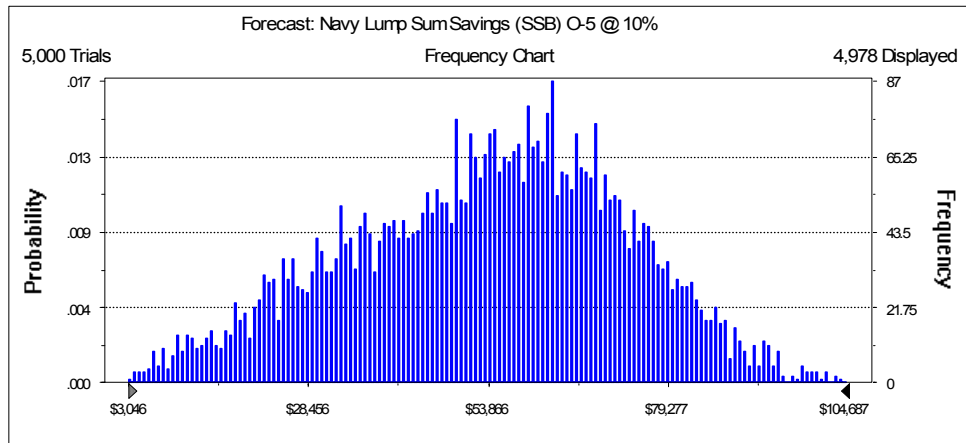
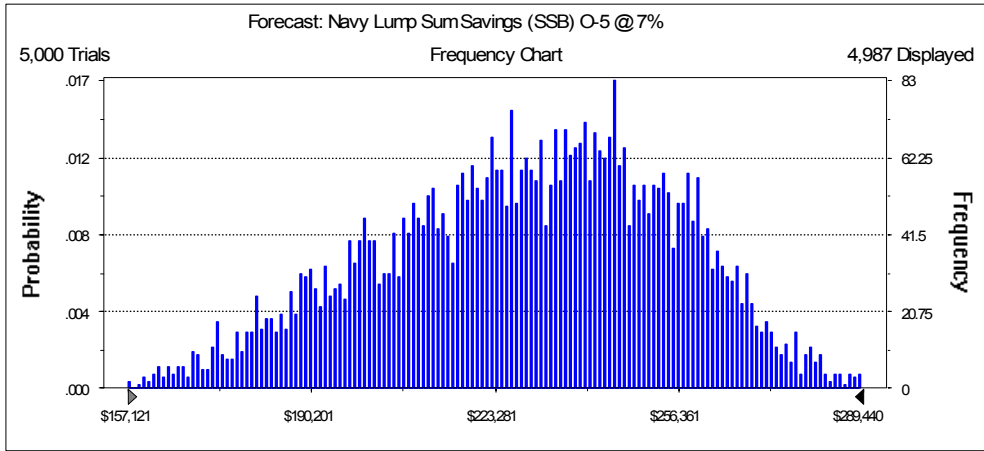


3. Commander (O-5)

Statistics: Navy Lump Sum (SSB) Savings - O-5			
Discount Rate	7%	10%	13%
Trials	5,000	5,000	5,000
Mean	\$228,683	\$53,351	(\$40,730)
Median	\$230,653	\$55,048	(\$39,785)
Mode	---	---	---
Standard Deviation	\$26,193	\$19,718	\$16,164
Variance	\$686,075,100	\$388,800,799	\$261,275,984
Skewness	-0.28	-0.25	-0.15
Kurtosis	2.52	2.57	2.61
Coeff. of Variability	0.11	0.37	-0.4
Range Minimum	\$145,505	(\$4,862)	(\$92,381)
Range Maximum	\$296,213	\$108,768	\$10,415
Range Width	\$150,709	\$113,630	\$102,797
Mean Std. Error	\$370.43	\$278.86	\$228.59

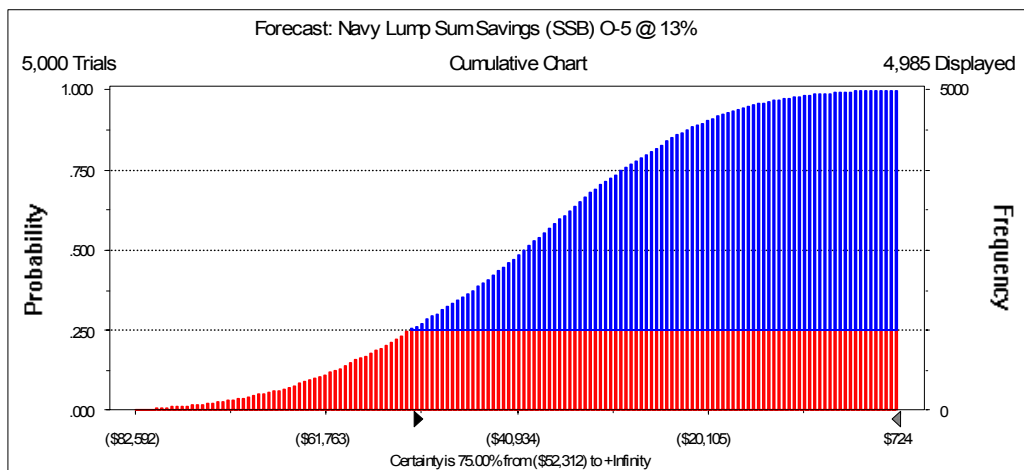
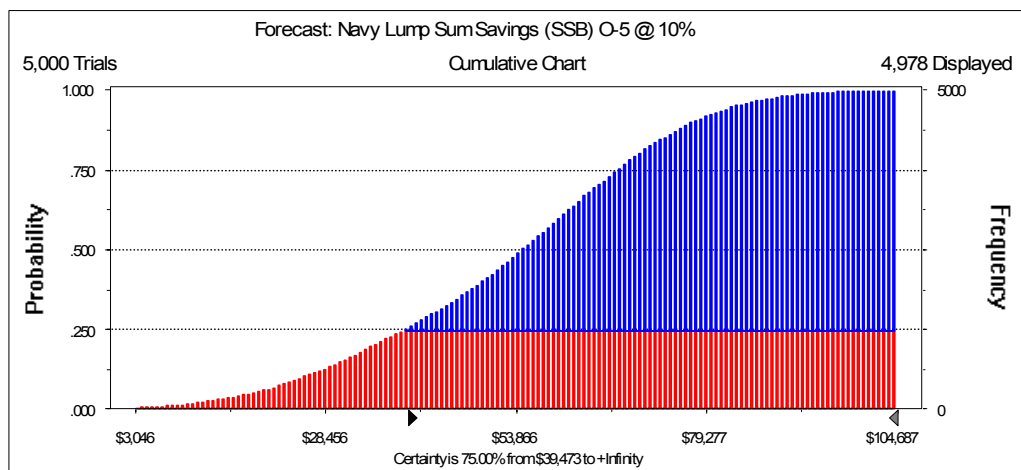
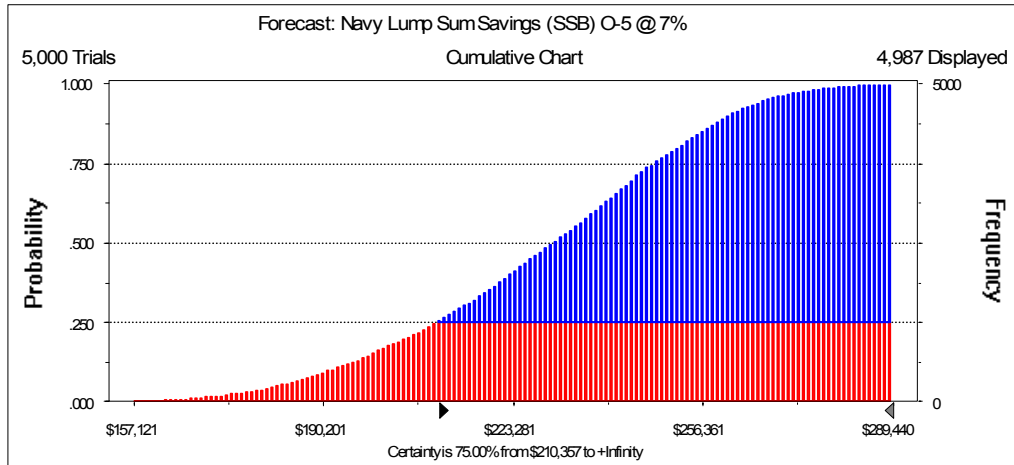
Percentiles:Navy Lump Sum (SSB) Savings - O-5			
	7%	10%	13%
0%	\$145,505	(\$4,862)	(\$92,381)
10%	\$191,919	\$25,871	(\$62,638)
20%	\$205,240	\$35,276	(\$54,961)
30%	\$214,948	\$43,180	(\$49,437)
40%	\$223,180	\$49,678	(\$44,256)
50%	\$230,653	\$55,048	(\$39,785)
60%	\$238,002	\$60,078	(\$35,708)
70%	\$244,650	\$65,028	(\$31,654)
80%	\$252,468	\$70,549	(\$26,446)
90%	\$261,235	\$77,874	(\$20,083)
100%	\$296,213	\$108,768	\$10,415

FREQUENCY GRAPHS FOR NAVY LUMP SUM (SSB) SAVINGS - O-5



CUMULATIVE GRAPHS FOR NAVY LUMP SUM (SSB) SAVINGS - O-5

Red shaded area represents Navy savings from least expensive 25% of O-5s

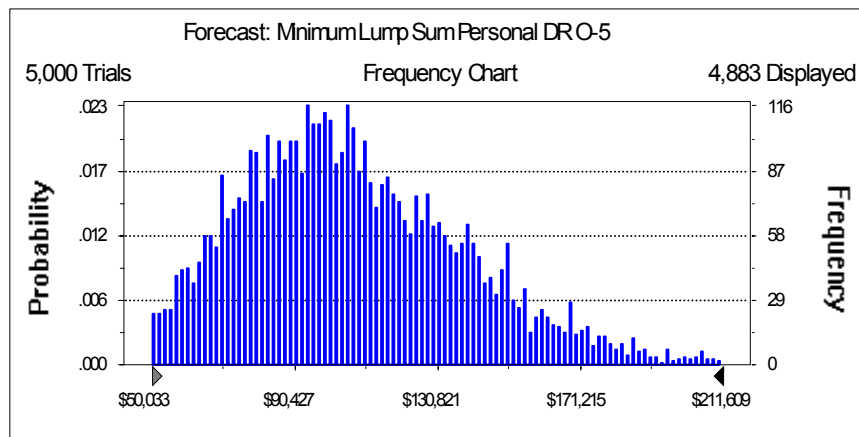
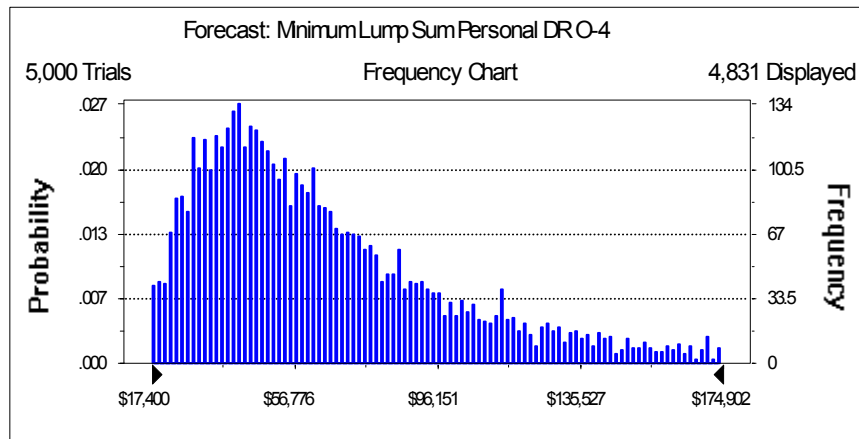
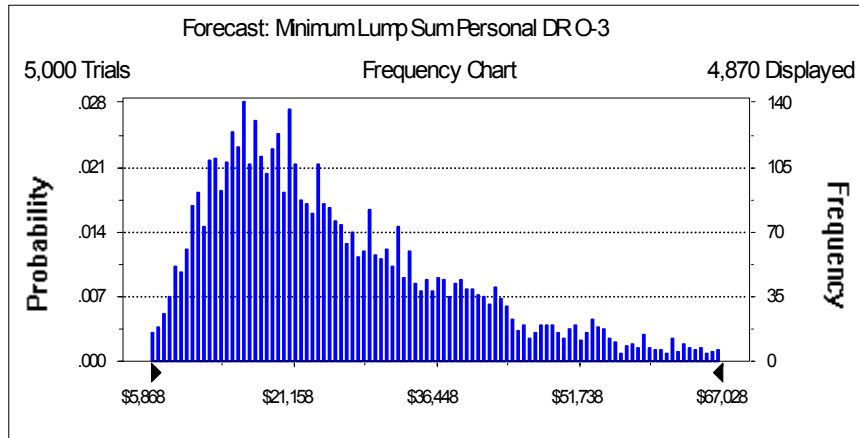


F. INDIVIDUAL MINIMUM REQUIREMENT (PERSONAL DISCOUNT RATE)

Statistics: Minimum Lump Sum Acceptable to Individual - Personal DR			
Rank	O-3	O-4	O-5
Trials	5,000	5,000	5,000
Mean	\$26,927	\$66,994	\$107,742
Median	\$22,902	\$56,509	\$103,555
Mode	---	---	---
Standard Deviation	\$15,292	\$39,973	\$33,993
Variance	\$233,851,430	\$1,597,807,068	\$1,155,525,173
Skewness	1.56	1.63	0.84
Kurtosis	6.77	6.79	4.44
Coeff. of Variability	0.57	0.6	0.32
Range Minimum	\$5,169	\$11,348	\$27,694
Range Maximum	\$145,810	\$397,399	\$302,258
Range Width	\$140,642	\$386,051	\$274,564
Mean Std. Error	\$216.26	\$565.30	\$480.73

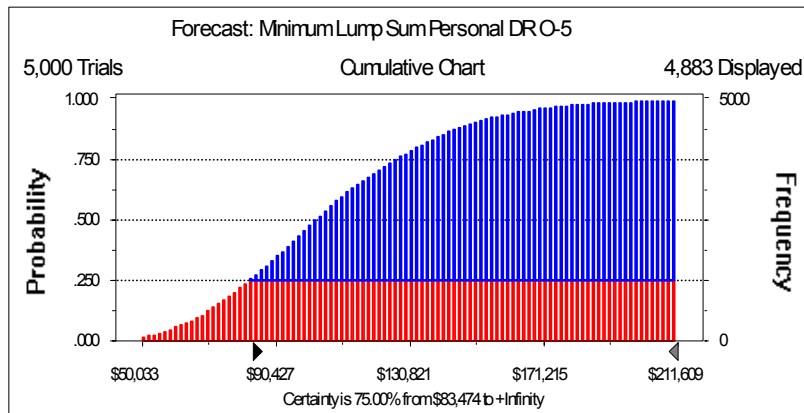
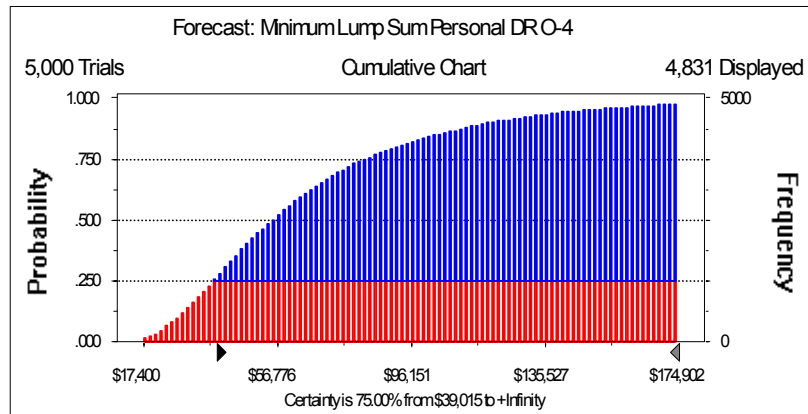
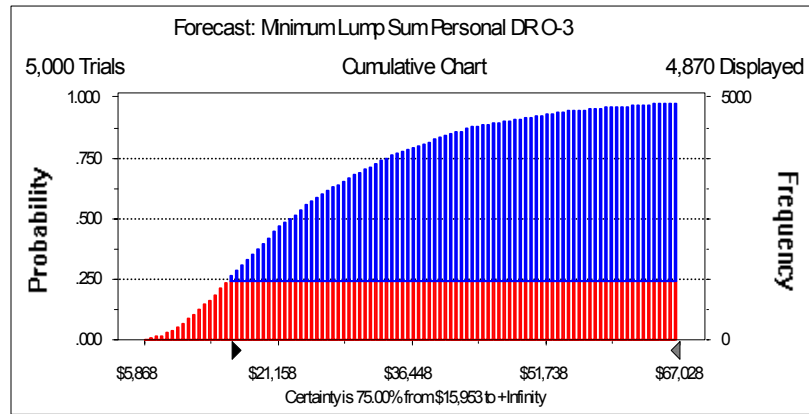
Percentiles: Minimum Lump Sum Acceptable to Individual - Personal DR			
	O-3	O-4	O-5
0%	\$5,169	\$11,348	\$27,694
10%	\$11,813	\$28,452	\$68,135
20%	\$14,676	\$35,657	\$78,962
30%	\$17,233	\$42,058	\$87,741
40%	\$19,918	\$48,697	\$95,913
50%	\$22,902	\$56,509	\$103,555
60%	\$26,494	\$65,016	\$111,656
70%	\$31,326	\$76,133	\$122,044
80%	\$37,576	\$92,525	\$134,481
90%	\$47,542	\$120,399	\$151,210
100%	\$145,810	\$397,399	\$302,258

FREQUENCY GRAPHS FOR MINIMUM INDIVIDUAL PAYMENT - PERSONAL DISCOUNT RATE



CUMULATIVE GRAPHS FOR MINIMUM INDIVIDUAL PAYMENT - PERSONAL DISCOUNT RATE

Red shaded area represents minimum offer required to ensure 25% of individuals separate



APPENDIX H – ACTIVE DUTY COST ANALYSIS

The following discussion describes the costs associated with active duty officers in ranks of Lieutenant (O-3) to Commander (O-5). While pay and allowances were based upon 2005 values, estimations of medical and non-cash compensation are based upon the best available data, derived from previous years, making comparison somewhat difficult. This analysis provides a general guideline of active duty costs to add to the retirement costs computed in the model. The assumption for all pay and benefits is that over the long run they will increase consistent with inflation. The numbers are used as if they are current and will be relatively close to the real values in the future.

A. BASIC PAY

Basic pay is based on rank and the years of service an officer has accumulated. Calculations for the active duty comparison are based upon the 2005 pay tables. Military pay is normally increased annually.

B. BASIC ALLOWANCE FOR HOUSING (BAH)

Basic Allowance for Housing (BAH) was calculated using the Fiscal Year 2005 Department of Navy Budget Justification. The numbers in the justification provided averages among ranks for domestic and overseas, as well as with dependent and without dependent categories. Based on these figures, averages were computed using the given manpower numbers in each category. This provided an average BAH for all personnel in each rank.

BAH is an entitlement based on location, dependent status, and rank. Considering all of the variables that comprise a BAH allowance, it is impossible to identify rates for specific individuals in specific locations given the scope of this analysis. The computations used to provide values for BAH are large approximations based on the entire military population. They are not intended to be precise numbers but rather to provide a value that will aid in evaluating the costs associated with an officer's total compensation. Although they are not precise, the BAH numbers were extracted from the

Department of the Navy's budget estimate, providing validity, and do provide the information necessary to evaluate costs of retaining officers on active duty. The BAH rate used for this analysis is a weighted average among the characteristics comprising BAH based upon the Department of the Navy's Budget. The yearly BAH values in the model are provided in the following table:

Weighted Average Annual BAH	
	2005
O-7	29,946
O-6	26,252
O-5	24,533
O-4	21,697
O-3	18,165

C. BASIC ALLOWANCE FOR SUBSISTENCE

Basic Allowance for Subsistence (BAS) is another common allowance provided to all officers. This payment is a set allowance, determined yearly, regardless of location, rank or dependent status. The BAS numbers in this analysis were derived from the Department of the Navy's Fiscal Year (FY) 2005 Budget Estimates in the justification of estimates (2004). The annual BAS used in active duty cost calculations is \$2,150.

D. SPECIAL PAY AND INCENTIVES

Selected personnel in the Navy also receive special payments and incentives for the job they perform, the location where they are stationed, or the skills that they possess. Some in this category include pilots and doctors as well as those serving in a combat zone. These payments are relatively small in relation to the other pay and allowances. This is consistent with the conclusion of Asch, Hosek, and Martin who determined that, "despite the large number of S&I (special and incentive) pays, they play a relatively small role in determining average total cash compensation (2002)." It is also difficult in a calculation that treats all Navy officers in general as one group to distinguish who should receive the payments and who should not. For these reasons, special pay and incentives are not included in calculating the cost for active duty officers. If a specific category of officers, such as pilots, were targeted for early separation incentives, special payments for

the specific category of officers should be included in the calculations to provide a more thorough cost estimate.

E. MEDICAL BENEFITS

Medical and dental benefits are part of an officer's non-cash compensation. In the Department of Defense, the medical insurance program is very beneficial for military personnel, but very costly for the Department of Defense. Military personnel and their family members have to make few payments when they receive medical treatment. This greatly helps with readiness and health of military personnel and their families. The downside is that the system can be used heavily or abused. There are no financial consequences for personnel to use the services, which results in over use. If personnel were required to pay for some of the care they received, they would be more judicious in deciding to seek medical attention. The military's medical bill is substantial and it was important to capture this cost in the analysis.

Medical costs were determined for 2002 based on a study conducted by CBO. This study approximated health care for Department of Defense Personnel and their families to be \$7,000 per year per service member (Murray, 2003).

F. OTHER NON- CASH COMPENSATION

The Department of Defense also provides many services to personnel, often at a discounted cost compared to civilian sector services. Some of these services include commissaries, exchanges, movie theatres, workout facilities, and child care. There are a large number of recreation facilities that are also maintained for use by military personnel. Although not all personnel take advantage of the opportunities and discounts, there is a large cost to the Department of Defense and the Navy to make these services available. When evaluating early separation programs, the cost of these services becomes important because reducing the force will in turn help to reduce some of these costs.

This cost to the Navy is hard to quantify. There are many services provided in different areas with different costs. There is also a large variation in the amount of use that these services and facilities receive. Finally, not all of the costs can be tied to the amount of use. There is a large amount of overhead that is incurred to maintain these

facilities regardless of use. The estimates provided by the CBO report value these costs above their most likely value. The CBO estimate for 2002 is \$12,000 per active duty member per year (Murray, 2003).

G. CALCULATIONS

1. Method of Calculations

The active duty savings calculations used the variables described in the previous section. Consistent with the scope of this analysis, only ranks of Lieutenant (O-3) through Commander (O-5) were observed. Calculations for each rank used average values of the characteristics of each rank. Eight, 13, and 18 years of service were used for Lieutenants (O-3), Lieutenant Commanders (O-4), and Commanders (O-5), respectively. The calculations referenced the pay tables for the corresponding rank and years of service. Each rank receives an increase in pay after two additional years. These increases are included in the model. The increases require basic pay to be broken down into further detail than required for the model simulation. For each two year period, the annual cost was discounted using a period of two years. The exception to this was for Lieutenant Commanders (O-4). Evaluation for this rank started at 13 years of service. As a result, the present value of the cost was only discounted for one year. The active duty costs were calculated for each rank for discount rates of 7%, 10%, and 13%. Individuals' preference for active duty compensation was also captured using a personal discount rate of 16%. The maximum amount the Navy would be willing to offer for early separation was computed using the active duty cost calculations and the retirement cost calculations from the model simulation described in Chapter VII. Likewise, the minimum that individuals would be willing to accept was computed using the model simulation and the active duty calculations. Combining the results for two different approaches (model simulation and average characteristics) is not completely accurate, but provides a general guideline for discussing the possible extra savings to the Navy when including active duty costs.

2. Calculation Results

The first table illustrates the results of the calculations described in section 1. The second table illustrates the savings to the Navy when considering active duty costs. The

third table illustrates the Navy's savings comparing its maximum offer required to separate 25% of officers and the minimum requirement of the individual based upon retirement costs. This table is reproduced from Chapter VII to compare savings from retirement and active duty calculations.

Active Duty Cost Calculations (Present Value)				
Retirement	7%	10%	13%	PDR
O-3	\$143,478	\$62,517	\$30,117	\$15,953
O-4	\$250,545	\$124,554	\$66,103	\$39,015
O-5	\$401,795	\$232,102	\$140,549	\$83,474
Active Duty	16%			
O-3	\$168,260	\$125,353	\$95,699	\$74,819
O-4	\$204,765	\$168,223	\$140,067	\$118,125
O-5	\$217,145	\$195,811	\$177,554	\$161,846
Total				
O-3	\$311,738	\$187,870	\$125,816	\$90,772
O-4	\$455,310	\$292,777	\$206,170	\$157,140
O-5	\$618,940	\$427,913	\$318,103	\$245,320

Navy Cost Savings Active Duty Calculation			
	7%	10%	13%
O-3	\$220,966	\$97,098	\$35,044
O-4	\$298,170	\$135,637	\$49,030
O-5	\$373,620	\$182,593	\$72,783

Navy Cost Savings Retirement Calculation			
	7%	10%	13%
O-3	\$127,525	\$46,564	\$14,164
O-4	\$211,530	\$85,539	\$27,088
O-5	\$318,321	\$148,628	\$57,075

Percentage of Savings Active vs Retired			
	7%	10%	13%
O-3	42%	52%	60%
O-4	29%	37%	45%
O-5	15%	19%	22%

** Percentage Calculation =

((Active Savings - Retired Savings)/Active Savings)*100%

3. Comparison of Active Duty Calculations and Retirement Calculations

Calculating the cost savings taking active duty cost into account generally provides more savings to the Navy. The savings are much greater for the 7% discount rate than they are for the 13% discount rate. This occurs because the higher discount rate is closer to the personal discount rate. For Commanders (O-5) there is a lower percentage of savings (19%) from using only retirement costs than from including active duty costs compared to Lieutenants (O-3) (52%) at a 10% discount rate. There is more of a cost to pay a higher retirement payment for Commanders (O-5). Commanders (O-5) are also closer to retirement, and there is a smaller stream of active duty costs to the Navy in this case. The data support these characteristics as well because there is a higher percentage of savings for Lieutenants (O-3) when considering active duty costs than any other rank. The reason for this is the opposite of the explanation for Commanders (O-5). Lieutenants are further from retirement and the retirement costs will be lower. They also have a longer time until retirement than more senior ranks. The active duty costs are higher for this reason.

It is important to consider active duty costs when manpower reductions occur in positions that are no longer needed and will not be filled. Active duty costs are more significant for lower ranks because more years of service are required until retirement. Conversely, for more senior ranks, the retirement costs to the Navy are more significant than the active duty costs. A model providing more thorough analyses of active duty costs in addition to the retirement costs of the model in this thesis will provide the Navy with a more accurate picture of the savings resulting from early separation incentives. This will provide the Navy with more information for the Navy to determine the amount it should offer when implementing early separation programs in the future.

LIST OF REFERENCES

- 2004 Guide to Retirement. (2004, June 21). Marine Corps Times. 6(24), 15.
- Arceneaux A. J. (1997). In Levy C. J., and Louvau G. E. (Eds.), Cost Benefit Analysis of Leasing vs. Purchasing Computers (Masters of Science in Management, ed.). Monterey, Ca: Naval Postgraduate School.
- Asch B.J., Hosek J.R., and Martin C.W. (2002) A Look at Cash Compensation for Active-Duty Military Personnel. Santa Monica, Ca: RAND Corp.
- Asch, B.J., and Warner, J.T. (2001). An Examination of the Effects of Voluntary Separation Incentives (RAND Publication No. MR-859-OSD). Santa Monica, Ca: RAND Corp.
- Astrella, M.G. (1998). In Mehay S., and Eitelberg M. (Eds.), An Analysis of the Effect of Prior-Enlisted Service on Navy Officer Performance (Masters of Science in Management). Monterey, Ca: Naval Postgraduate School.
- Bazon, C., and Smetters, K. (1999). Discounting Inside the Washington D.C. Beltway. The Journal of Economic Perspectives, 13(4), 213.
- Brown J.C. (2003). In Eaton D., Gue K., and Malina M. (Eds.), Cost Benefit Analysis of the Department of the Navy's F-5 Tiger II Contract (Masters of Business Administration ed.). Monterey, Ca: Naval Postgraduate School.

Chapter Fifteen, Officer Promotions. All Hands. (1997, August). [Online], Available: www.chinfo.navy.mil/navpalib/allhands/ah0897/aug-pg89.html. Accessed:

November 8, 2004.

Chermak, J.M., Lowe, J.K., and Webb, N.J. (1997). A New Look at a New Discount Rate: Discounting Proposed Projects within the U.S. Department of Defense. The Armed Forces Comptroller 42(1), 27.

Crawley V. (2004) Cheap Labor. Navy Times. 53(51), 14.

Department of Defense Office of the Actuary. (2003). Fiscal Year 2003 Statistical Report on the Military Pay System. Arlington, Va: Office of the Actuary.

Department of the Navy. (2004). Department of the Navy Fiscal Year (FY) 2005 Budget Estimates: Justification of Estimates. Washington DC: Department of the Navy.

Fuchs S. A. (2000). In Gates W., and Liao S. (Eds.), Cost Benefit Analysis of Alternatives to the NROTC Flight Physical Screening Process (Masters of Science in Management ed.). Monterey, Ca: Naval Postgraduate School.

General Accounting Office. (1985). Navy Management and Use of the Selective Reenlistment Bonus Program. (In a Report to the Chairman, Subcommittee on Manpower and Personnel, Committee on Armed Services, United States Senate). Wahington, DC: General Accounting Office.

Giarrizzo, S.J. (1993). In Mehay S.L., and Mitchell C.A. (Eds.), An Analysis of Enlisted Early Separations Under the Navy's VSI/SSB Program: The Impact of Eligibility and Program Benefits (Masters of Science in Management ed.). Monterey, Ca: Naval Postgraduate School.

Goldberg, M.S. (1998). Discount Rates for Government Investment Projects: The Economic Logic Behind OMB Circular A-94. The Engineering Economist, 43(4), 290.

Hartman, W.R. (1990). One Thousand Points of Light Seeking a Number: A Case Study of CBO's Search for a Discount Rate Policy. Journal of Environmental Economics and Management, 18(2), S3.

Healy, M. (1992, February 23). Military Combat in Job Market with Defense Cutbacks, Many Officers will be Forced into Retirement. Los Angeles Times, p. 1.

Hemleben, J.F. (1993). In Roberts B.J., and Weitzman R.A. (Eds.), USMC Voluntary Separation Incentive and Special Separation Benefit: Who's Leaving? A Focus on Quality. (Masters of Science in Management ed.). Monterey, Ca: Naval Postgraduate School.

Kirby, M. (1993). In Mehay S.L., and Mitchell C.A. (Eds.), A Multivariate Analysis of the Effects of the VSI/SSB Separation Program on Navy Enlisted Personnel (Masters of Science in Management ed.). Monterey, Ca: Naval Postgraduate School.

Krueger, A.B. (2001, May 24). Pentagon Pay Plan Shows that it Doesn't Always Pay to Take the Money and Run. New York Times, p. C.2.

- Lind, C.R. (1990). Reassessing the Government's Discount Rate Policy in Light of New Theory and Data in a World Economy with a High Degree of Capital Mobility. Journal of Environmental Economics and Management, 18(2), S8.
- Liu, L. (2003). A Marginal Cost of Funds Approach to Multi-Period Public Project Evaluation: Implications for the Social Discount Rate. Journal of Public Economics, 87(7-8), 1707.
- Lyon, & M, R. (1990). Federal Discount Rate Policy, the Shadow Price of Capital, and Challenges for Reforms. Journal of Environmental Economics and Management, 18(2), S29.
- Martucci, T. A. (2000). In Gates, W., and Simon, C. (Eds.), Cost Benefit Analysis for US Navy's Closed Circuit Television System (Masters of Science in Management ed.). Monterey, Ca: Naval Postgraduate School.
- Maze, R. (2004, October 18). Pay Dirt. Marine Corps Times, 6(41), 15.
- Mehay, S.L., and Hogan, P.F. (1998). The Effect of Separation Bonuses on Voluntary Quits: Evidence from the Military's Downsizing. Southern Economic Journal, 65(1), 127.
- Moore, M.A., Boardman, A.E., Vining, A.R., Weimer D.L., and Greenberg, D.H. (2004). "Just Give Me a Number!" - Practical Values for the Social Discount Rate. Journal of Policy Analysis and Management, 23(4), 789.

Murray, C.T. (2003). Military Compensation: Balancing Cash and Noncash Benefits. Washington, DC: Congressional Budget Office.

Office of Management and Budget. (1992). Circular A-94: Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs. Washington, DC: Office of Management and Budget.

Office of the Chief Economist. (1991). Discount Rate Policy. Washington, DC: United States General Accounting Office.

Pleeter, S. (2004) Pay and Compensation Service and Unified Command. Presentation to the Senior Enlisted Advisors Conference, October 25,2004.

Quirk, J.P., and Terasawa, K.L. (1987). The Choice of Discount Rate Applicable to Government Resource Use: Theory and Limitations (R-3464-PA&E). Santa Monica, Ca: RAND Corp.

Quirk, J.P., and Terasawa, K.L. (1991). Choosing a Government Discount Rate: An Alternative Approach. Journal of Environmental Economics and Management, 20(1), 16.

Rogge, F. (1996). In Mehay S., and Dougherty J.A. (Eds.), An Analysis of the Separation Bonus (VSI/SSB) Program Using the Annualized Cost of Leaving Model (Masters of Science in Management ed.). Monterey, Ca: Naval Postgraduate School.

Scheraga, J.D. (1990). Perspectives on Government Discounting Policies. Journal of Environmental Economics and Management, 18(2), S65.

Sewell, D. (1994). In Mehay S.L., and Hidebrant G.(Eds.), An Analysis of Enlisted Early Separations Under the Air Force's and Navy's VSI/SSB Programs: a Comparative Study (Masters of Science in Management ed.). Monterey, Ca: Naval Postgraduate School.

Smith, M. M. (1999). The Drawdown of the Military Officer Corps. Washington, DC: Congressional Budget Office.

TERA Website (2003) [Secure Website], Available:

http://www.dmdc.osd.mil/tera/owa/ShowPage?p=INDEX&p_SID=VNNYWSQQZHG.

Accessed: 10 October, 2004.

Viltz, D. (2004). In Gates W., and Mutty J.E. (Eds.), Analysis of Separation Pay Options (Masters of Business Administration ed.). Monterey, Ca: Naval Postgraduate School.

Warner, J.T., and Pleeter, S. (2001). The Personal Discount Rate: Evidence from Military Downsizing Programs. The American Economic Review, 91(1), 33.

Zerbe, R.O., Han, X., Layton, D. and Leshine, T. (2002, October). A History of Discount Rates and Their Use by Government Agencies. [Online], Available: http://faculty.washington.edu/zerbe/docs/discount_rates. Accessed October 8, 2004.

INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center
Ft. Belvoir, Virginia
2. Dudley Knox Library
Naval Postgraduate School
Monterey, California
3. Marine Corps Representative
Naval Postgraduate School
Monterey, California
4. Director, Training and Education, MCCDC, Code C46
Quantico, Virginia
5. Director Marine Corps Research Center, MCCDC, Code C40RC
Quantico, Virginia
6. Marine Corps Tactical Systems Support Activity (Attn: Operations Officer)
Camp Pendleton, California
7. Professor William Gates
Mail Code: GB/Gt
Graduate School of Business and Public Policy
Monterey, California
8. Professor John E. Muttu
Mail Code: GB/Mu
Graduate School of Business and Public Policy
Monterey, California